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A SYSTEMATIC TREATMENT OF
THE NATIVE UNIFOLIOLATE CROTALARIAS
OF NORTH AMERICA (LEGUMINOSAE)^{1, 2}

DONALD R. WINDLER

Crotalaria is a large genus of tropical, subtropical, and temperate plants comprised of about 550 species, over 400 of which occur in Africa. In 1939 Senn reported 31 species for North America with the majority growing in Mexico and the West Indies; only 21 of these species were considered to be native. Eight of the 21 species, including the Linnean *C. sagittalis*, form a group that is so distinctive that Rafinesque (1837) separated it into the subgenus *Iocaulon*. The *Iocaulon*³ *Crotalarias* are annual or perennial plants characterized by simple leaves; decurrent stipules, when present; terminal or leaf-opposed inflorescences; and glabrous, inflated fruits that become black at maturity. Senn (1939) indicated that this is the most difficult group of North American *Crotalarias* in which to delimit species and suggested the need for further work.

¹A portion of a dissertation submitted as partial fulfillment of the requirements for the Doctor of Philosophy Degree in the Department of Botany, University of North Carolina at Chapel Hill.

²Contribution number 7 from Towson State College Herbarium. Cost of Publication of illustrations assisted by the Towson State College Faculty Research Fund.

³The name *Iocaulon* will be used as an adjective throughout this paper to refer to the unifoliolate *Crotalarias* related to *C. sagittalis*.

The history of the classification of *Crotalaria* has been reviewed by Baker (1914), Senn (1939), and Polhill (1968). While Baker treated the African species of *Crotalaria* primarily, he also reviewed the history of the classification of the genus and discussed its separation from the closely related genus *Lotononis*. Senn reviewed rather briefly the nomenclatural history of *Crotalaria* in North America, and discussed the placement of the North American species into sections described by Baker. Senn's treatment includes a key to the species, nomenclature and synonymy, Latin descriptions for newly described species, lists of specimens examined, and a few comments on each of the taxa. Most species lack descriptions and all lack illustrations, which makes it difficult to identify a plant if the key only narrows the choice to a group of species.

Polhill (1968), while dealing primarily with the African species of *Crotalaria*, presented a discussion of the history of generic subdivisions, discussed typification of the genus, and proposed a new arrangement of species into sections based on combinations of flower characters. The characters used were: (1) type and position of standard appendages, (2) twisting of the keel, (3) lobing of the calyx, (4) calyx-keel length ratio, (5) pubescence of the style, (6) style shape, and (7) receptacle size. Polhill placed *C. sagittalis* and its relatives in the section *Calycinae* Wight & Arnott. All the characters that Polhill used for this placement were found to be consistently present in the Iocaulon *Crotalaria*s studied.

COLLECTIONS STUDIED

In addition to the personal collections made in the United States and Mexico, specimens were borrowed from twenty-one herbaria. The names and locations of the herbaria from which specimens were borrowed appear below, accompanied by the abbreviation of each as listed in *Index Herbariorum*, except in one case, marked by an asterisk, where no listing could be found for the herbarium and an arbitrary abbreviation is used.

A — Arnold Arboretum, Cambridge, Massachusetts. ALU — University of Alabama, University, Alabama. AUA — Auburn University, Auburn, Alabama. GA — University of Georgia, Athens, Georgia. GH — Gray Herbarium, Cambridge, Massachusetts. LAF — University of Southwestern Louisiana, Lafayette, Louisiana. MICH — University of Michigan, Ann Arbor, Michigan. *MISS — University of Mississippi, University, Mississippi. NCU — University of North Carolina, Chapel Hill, North Carolina. NY — The New York Botanical Garden, New York, New York. SIU — Southern Illinois University, Carbondale, Illinois. TEX — University of Texas, Austin, Texas. UC — University of California, Berkeley, California. US — United States National Museum, Washington, D.C. USF — University of South Florida, Tampa, Florida. WIS — University of Wisconsin, Madison, Wisconsin.

BM — British Museum of Natural History, London, England. G — Conservatoire et Jardin Botanique, Geneva, Switzerland. K — Royal Botanic Gardens, Kew, Great Britain. MEXU — Universidad Nacional de México, Mexico City, Mexico. P — Museum National d'Histoire Naturelle, Paris, France.

Crotalaria plants from more than 60 locations in the United States and Mexico were grown from seed at the North Carolina Botanical Garden, Chapel Hill, during the summer of 1968. Data from the garden plantings were used in evaluating the status of taxa. Another paper detailing the results of the field and garden studies is published elsewhere (Windler, 1973).

SYSTEMATIC TREATMENT

CROTALARIA (Dillenius ex Linnaeus, Hort. Cliff. p. 218, 1737, pro parte) L., Sp. Pl. p. 714 pro maxima parte. Type species: *Crotalaria lotifolia* L. (see Polhill, 1968 pp. 174-5).

GENERAL DESCRIPTION OF THE NATIVE IOCAULON CROTALARIAS

Erect, ascending, spreading, decumbent, or procumbent

terrestrial herbs or shrubs. Root a taproot with slender branches, nodules frequently present. Stems single in the erect species to many in the decumbent and procumbent species, the epidermis green, frequently becoming purple, with an indument varying from nearly glabrous to sericeous, of spreading or appressed, simple trichomes. Stipules absent or varying from a pair of subulate lobes projecting from near the leaf base to inverted-sagittate, decurrent, foliaceous appendages which wing the stem for a portion of the subtending internode, a full internode, or for several of the subtending internodes, the lobes spreading, incurved toward the stem or parallel to the stem. Leaves alternate, unifoliolate, undivided, entire, ciliate, membranaceous to fleshy, broadly ovate to lanceolate or linear, 0.9-10.2 cm. long, 0.3-4.6 cm. wide, the adaxial surface dark green, glabrous, or with spreading or appressed, simple trichomes, the abaxial surface usually lighter green than the adaxial and with spreading or appressed simple trichomes; petioles 0.5-3 mm. long.

Inflorescences loose racemes, peduncles borne terminally, or opposite leaves and 0.0-3 cm. below the node. Bracts lanceolate, elliptic, subulate, or linear, to 14 mm. long, one at the base of each flower, frequently persistent after flower or fruit abscission. Flowers papilionaceous. Calyces bilabiate, deeply cleft, the upper two lobes free and broader than the lower three, the lower usually remaining coherent, the calyx bearing two lateral bracteoles, one on either side. Standards (vexillum, banner) orbicular, obovate, or elliptic-oblong, the apex rounded or retuse, 4 mm. shorter to 6 mm. longer than the upper calyx lobes, yellow, the adaxial surface frequently becoming red-tinged, lined or unlined, nearly glabrous with a few trichomes along the main vein on the adaxial surface, with lamelliform appendages at the base of the abaxial surface of the blade. Wings (alae) oblong, attached by a stalk continuous with the lower margin (cleaver-shaped), the blades usually puckered between some of the veins, yellow. Keel (carina) petals twisted at the tip, white or greenish-white, lanate-ciliate. Stamens 10,

monadelphous, the staminal tube split on the upper side, anthers dimorphic, with basifixed long anthers alternating with medifixed short anthers, the short anthers positioned above the elongate at anthesis. Styles geniculate at the base, bearing a spiral line of trichomes transversing the length and culminating in a tuft of trichomes on the stigma.

Fruit an inflated, sub-cylindric, short-stipitate legume, glabrous inside and out, becoming black at maturity. Seeds 7-46 per pod, oblique-cordiform, smooth.

The systematic treatment presented here covers twelve native North American unifoliolate species of *Crotalaria* section *Calycinae*. The descriptions are based on materials collected during the study and on numerous herbarium specimens. Measurements of stipule width are taken at the base of the sinus between the two lobes and include the width of both at that point. Length measurements of the calyx and standard are made from the base of the torus to the tip of the respective structure in the undissected flower. Illustrations were prepared by Mrs. Jerry Meyer.

Since data on cross-fertility between the numerous populations sampled is not available, taxa have been distinguished primarily on patterns of morphological discontinuity. It is assumed that these discontinuities also reflect breeding discontinuities, especially in areas where species are sympatric. In mountainous areas, however, many populations are well isolated, frequently leading to morphological discontinuity between populations. In these instances greater emphasis has been placed on similarities in interpreting relationships.

Diagnostic characters that have been useful in the group are plant habit; general size; position of inflorescence; presence, absence, size, and shape of the stipules; length and position of trichomes; and flower size. Most of the diagnostic characters are present on the plants during the entire growing season.

The synonymy includes only those names that were possible to check either against types or clear descriptions. A

special effort is made to point out all places where the present treatment differs from that of Senn's.

A set of duplicate specimens from the author's field collections has been deposited in the herbarium of the University of North Carolina at Chapel Hill (NCU).

KEY TO THE SPECIES OF IOCAULON CROTALARIAS
WHICH OCCUR IN NORTH AMERICA

- A. Inflorescence terminal, or terminal and also leaf-opposed. B.
- B. Plants with decurrent stipules. (West Indies, Central and South America). 1. *C. pilosa*.
- B. Plants without decurrent stipules. C.
- C. Shrubs and subshrubs with diffuse habit. . . D.
- D. Peduncles 9 cm. or more long; calyx 15-20 mm. long. (Mexico, Central and South America). 2. *C. nitens*.
- D. Peduncles 6 cm. or less long; calyx 10-11 mm. long. (Northwestern Mexico).
. 3. *C. brevipedunculata*.
- C. Herb with decumbent or ascending habit. (Western Mexico). 4. *C. polyphylla*.
- A. Inflorescence not terminal, always leaf-opposed.
. E.
- E. Plants erect or strongly ascending. F.
- F. Stem pubescence spreading; adaxial leaf surfaces regularly pubescent. G.
- G. Stipules with lobes recurved. (West Indies and South America). 5. *C. stipularia*.
- G. Stipules with lobes spreading. (Throughout). 6. *C. sagittalis*.
- F. Stem pubescence appressed, adaxial leaf surfaces glabrous or with appressed trichomes. H.
- H. Upper leaf surface glabrous. I.
- I. Plants perennial; stipules usually conspicuous; peduncles 7.5-23 cm. long.

- (Southern United States).
- 7. *C. purshii*.
- I. Plants annual; stipules absent or inconspicuous; peduncles 2.5-8 cm. long. (Mexico and Central America).
- 8. *C. quercetorum*.
- H. Upper leaf surface bearing trichomes. . . J.
- J. Peduncles 0.5-2 cm. long, usually as thick as the stem; stipules present; trichomes dense, obscuring the stem. (Mexico). 9. *C. mexicana*.
- J. Peduncles 2.5 cm. long or longer, thinner than the stem; stipules absent; trichomes not obscuring the stem (except occasionally near the top). (Southern United States). . . 10. *C. rotundifolia*.
- E. Plants decumbent, procumbent or spreading. . . K.
- K. Mature plants decumbent or procumbent from a thick taproot, stems usually less than 6 dm. long; trichomes on stem 0.3-3.2 mm. long. (Mexico and Southeastern United States). . .
- 10. *C. rotundifolia*.
- K. Mature plants diffuse or spreading, stems usually more than 6 dm. long; trichomes on stem usually less than 1 mm. long. (Mexico). . . L.
- L. Calyx 13-20 mm. long; stipules 0.5-2.7 cm. broad. (Mexico). . . 11. *C. bupleurifolia*.
- L. Calyx 7.5-12 mm. long; stipules narrow or absent. (Mexico). . . 12. *C. nayaritensis*.

1. ***Crotalaria pilosa*** Miller, Garden Dict. No. 2. 1768, non *C. pilosa* Roxb. ex Mart. Denkschr. Konigl. Akad. Wiss. München 6: 156, 1920, non *C. pilosa* Thunb. Prod. Pl. Capensium 125.

Crotalaria pterocaula Desv. J. Bot. (Desvaux) 3: 76. 1814. Type: not located.

Crotalaria genistella HBK. Nov. Gen. et. Sp. Pl. 6: 398. 1824. Type: *Humboldt 2050* (P, IDC Microfiche observed).

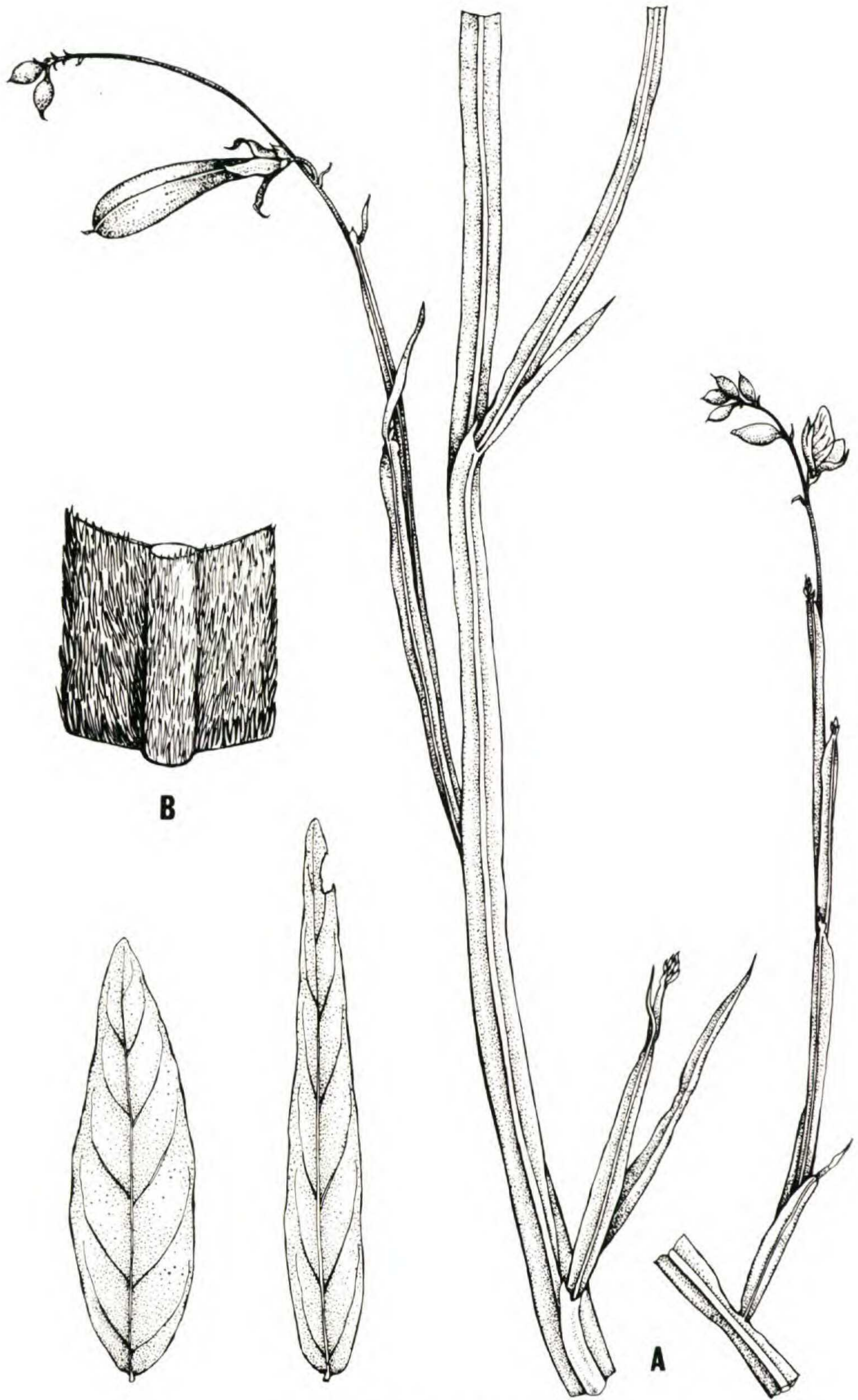
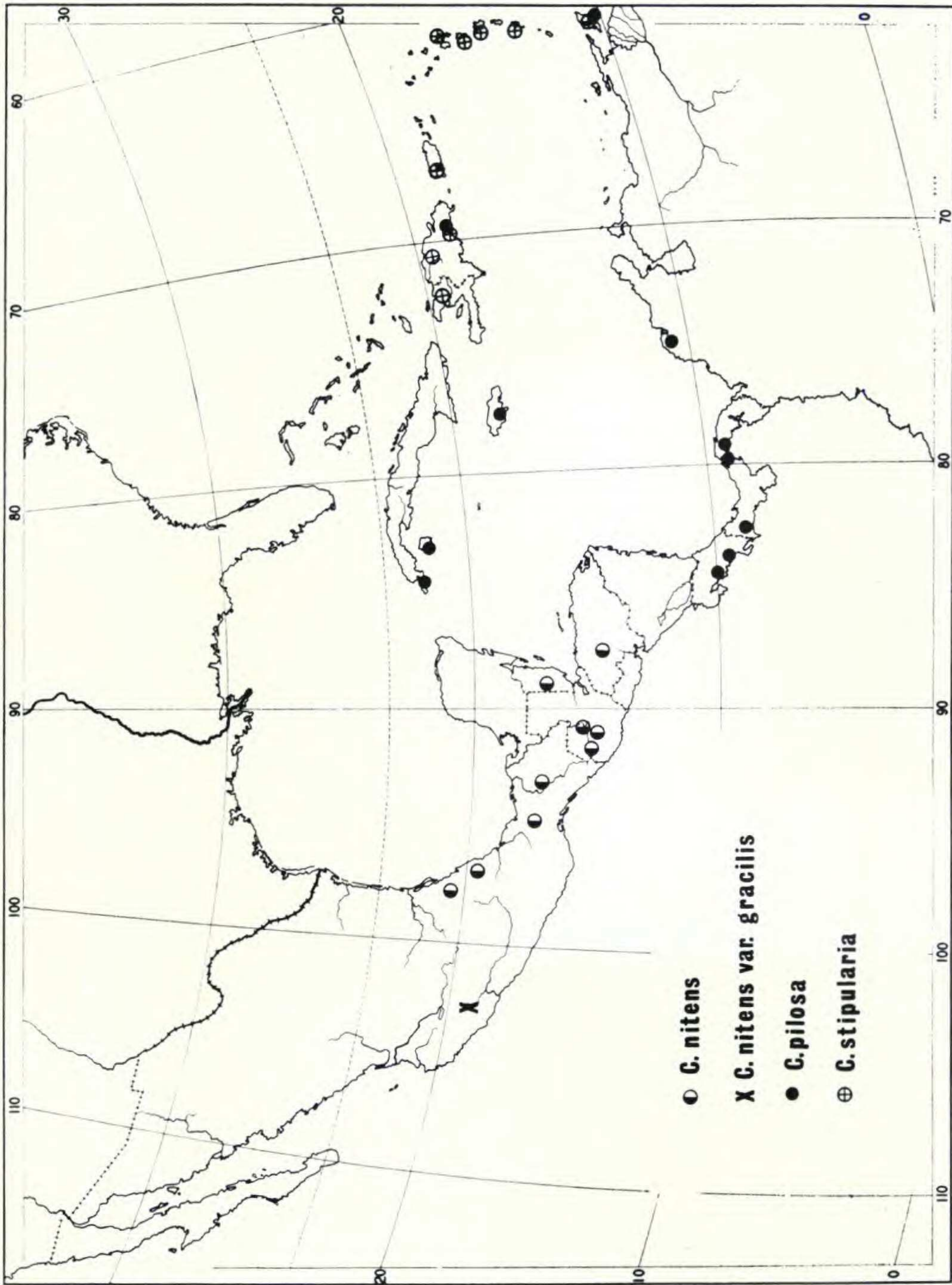


Figure 1. *Crotalaria pilosa*.

- A. Habit and leaf variation
B. Stem



Map 1. Distribution of *Crotalaria nitens* var. *nitens*, *C. nitens* var. *gracilis*, *C. pilosa*, and *C. stipularia*.

Crotalaria pilosa Miller var. *skutchii* Senn, *Rhodora* 41: 331. 1939. Type: *Skutch 3071* (GH).

Annual erect herb with a taproot to 0.4 cm. thick. Stem single, 2.8-9.5 dm. long, 1.3-4 mm. thick, the longest internode 2.8-8.2 cm. long; vestiture of appressed or loosely appressed trichomes 0.5-1.5 mm. long. Stipules present, decurrent more than the length of the internode, 0.3-0.8 cm. wide, the width constant, the lobes 2.1-9.7 mm. long, usually not spreading. Leaves elliptic, lanceolate, narrowly lanceolate, or linear, 3.3-8.6 cm. long, 3.5-25 mm. wide, base rounded to cuneate, the apex acute; vestiture of both surfaces of appressed trichomes 0.4-2 mm. long; petioles 1-1.3 mm. long. Inflorescences terminal or leaf-opposed and terminal, peduncles 4.5-12 cm. long. Bracts sessile, linear, or subulate, 3.1-4 mm. long, 0.3-0.5 mm. wide; pedicels 3-4.3 mm. long. Calyces 9-11.5 mm. long, the tube 2.5-3.1 mm. long, with appressed, loosely appressed, or somewhat spreading trichomes 0.5-1 mm. long; bracteoles elliptic, narrowly elliptic, or subulate, 2.5-4 mm. long, 0.4-0.5 mm. wide. Corollas yellow, the standards 9-12.8 mm. long, equaling or to 1.7 mm. longer than the upper calyx lobes; elongate anthers 1.5-2 mm. long, short anthers 0.3-0.5 mm. long; style 5.5-5.8 mm. long. Fruits 2.5-3.6 cm. long, breadth not known; seeds tan, brown, or red-brown, 15-23 per pod, 2-2.5 mm. long. Chromosome number: $n=16$. Flowering time: July-March. Habitat: sandy and gravelly soils in fields and open pine woods, elevation sea level to 2,400 feet. Range: Costa Rica, Cuba, Jamaica, Panama. (Also widely distributed in South America.) Figure 1, Map 1.

Type: "La Vera Cruz in New Spain" (Mexico, Cuba or Jamaica?), *Houstoun* (BM; photo., NY!).

In spite of the fact that Miller, in his original description, cited *Crotalaria pilosa* as "growing naturally at La Vera Cruz in New Spain", no specimens have been observed from Veracruz, Mexico. The citation appears to be in error. The probable true type locality was either in Cuba or Jamaica. Senn, in his treatment of *C. pilosa*, recognized the species as being composed of three varieties. Senn's

variety *skutchii* is here treated as being a part of variety *pilosa*; his variety *robusta* is transferred to *C. bupleurifolia* and treated as a variety of that species. No field collections were made of *C. pilosa* during this study and no seed was obtained for garden plantings.

Crotalaria pilosa is characterized by its erect habit, terminal or leaf-opposed and terminal inflorescences, and stipules that wing the stem for more than one node below the node of origin (Figure 1). Occasional specimens have spreading lobes at the summit of the stipules. Such specimens observed are *Britton, Britton, & Shafer* 734 (NY) and *Bro. Leon & Fr. M. Rosca* 8837 (NY), both from Cuba. *Crotalaria pilosa* is alone among the species covered in this treatment in possessing both terminal inflorescences and stipules.

REPRESENTATIVE SPECIMENS: COSTA RICA. Cina Grande, entre San Ramon y Otevas, *Brenes* 11332 (NY). CUBA. Isle of Pines: pinelands, *Britton, Britton, and Wilson* 14615 (NY, US); PINAR DEL RIO: near Rio de las Vueltas, N of S. Diego de los Banos, *Bro. Leon* 4908 (GH). DOMINICAN REPUBLIC. TRUJILLO: between Bayaguana and Guerra, *Howard and Howard* 9924 (GH). JAMAICA. Upper Clarendon, James Hill Savannah, *Harris* 12844 (GH, NY, US). PANAMA. Ancon Hill, Canal Zone, open hillside, *Killip* 12075 (US). TRINIDAD. Without date or specific locality, *de Suber* 369 (P).

2. *Crotalaria nitens* HBK. Nov. Gen. et Sp. 6: 399. 1824.

Crotalaria bracteata Schlecht. et Cham. Linnaea 5: 575. 1830, non Roxburgh, Hort. Bengal 54. 1814. (Type: *Schiede* 597, Hacienda de la Laguna, (B; photo., F!).

Crotalaria schiedeana Steudel, Nomen. Botanicus. 1: 445. 1840. Type: same as for *C. bracteata* for which this was a nomen nov.

Shrub with unknown root type. Stems 5-15 dm. long, 2-4 mm. thick, the longest internode 1-5.5 cm. long; vestiture of appressed or loosely appressed trichomes, 0.5-1 mm. long. Stipules absent. Leaves elliptic, lanceolate, oblong, or oblanceolate, 2.5-7.5 (10) cm. long, 3.5-18.5 mm. wide, base rounded to cuneate, the apex rounded, acuminate, or acute; vestiture of both surfaces of appressed or loosely appressed

trichomes, 0.3-1 mm. long; petioles 1.3-3 mm. long. Inflorescences terminal, peduncles 6-51 cm. long. Bracts petiolate, lanceolate, the petioles 0.3-1 mm. long, the blades 4-14 mm. long, 0.6-3 mm. wide; pedicels 4.1-7 mm. long. Calyces 15-18 (20) mm. long, the tubes 3.3-5 mm. long, bearing appressed or loosely appressed trichomes 0.3-1 mm. long; bracteoles lanceolate, elliptic-lanceolate or linear, 4.5-9 mm. long, 0.5-1.4 mm. wide. Corollas yellow, the standards 13.5-19 (22) mm. long, equaling to 2.5 mm. longer than the upper calyx lobes; elongate anthers 2.2-3.6 mm. long, short anthers 0.6-1.2 mm. long; styles 8.5-11.5 mm. long. Fruits 2.5-3.2 cm. long, breadth not known; seeds grey-brown, brown, or red-brown, 26-40 per pod, 1.8-2.8 mm. long. Chromosome number: not known. Flowering time: September-December. Habitat: bare soil, dry open mountainsides and pinelands, elevation 4,000-7,200 feet. Range: Guatemala; Mexico: Chiapas, Jalisco, Oaxaca, Veracruz (Also widely distributed in South America).

Type: Mariquita (Colombia), *Humboldt* (P, IDC microfiche observed).

A photograph of the type of *Crotalaria nitens* was observed in the IDC microfiche photographs of the Humboldt, Bonpland, and Kunth herbarium (P). It bears only the name *C. nitida* and the location Mariquita which is also mentioned in the location sites for *C. nitens*. It compares favorably with the photograph examined by Senn (1939) of the "co-type" in the Willdenow Herbarium. Senn's application of the name is followed in this treatment.

Crotalaria nitens is characterized by its shrubby habit, lack of stipules, terminal inflorescences, and large flowers. Of the North American species, it most resembles *C. brevipedunculata* but differs from it in having a larger flower size and longer peduncles.

Two varieties are recognized:

- Peduncles stout, 1-2 mm. thick; bracts 7.5-14 mm. long, 1.2-3 mm. wide. 2a. *C. nitens* var. *nitens*.
 Peduncles slender, 0.5-0.6 mm. thick, bracts 4-5 mm. long, 0.6-0.8 mm. wide. 2b. *C. nitens* var. *gracilis*.

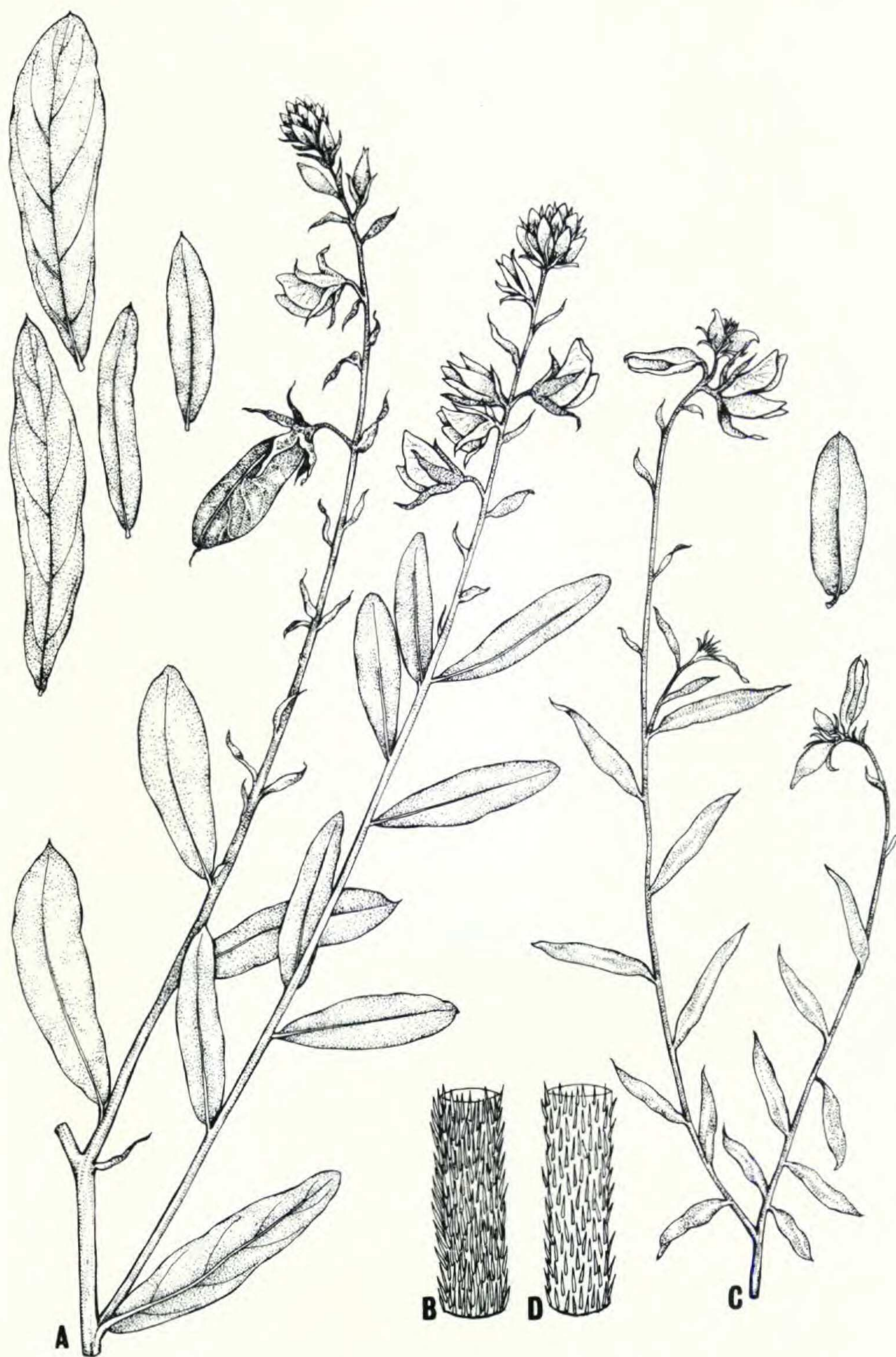


Figure 2. *Crotalaria nitens* var. *nitens*.

A. Habit and leaf variation

B. Stem

Crotalaria nitens var. *gracilis*.

C. Habit

D. Stem

2a. *Crotalaria nitens* HBK var. *nitens* Figure 2, Map 1.

REPRESENTATIVE SPECIMENS: **BRITISH HONDURAS.** EL CAYO: near Hydram, Rio Frio Augustine, Mt. Pine Ridge, *Hunt* 214 (US). **GUATEMALA.** VERAPAZ: Coban, 1,350 m., *Türkheim* 1948 (MICH, NY, US). **HONDURAS.** Comayagua, near Siguatepeque, 1,080-1,400 m., *Standley* 56370 (US). **MEXICO.** CHIAPAS: Municipio of Tenejapa, 6,000 ft., *Breedlove* 10976 (US); OAXACA: Entre Puerto Eligio a Comaltepec, *Calderon* 394 (MICH, US); VERACRUZ: Zacuapan, *Purpus* 8007 (NY, US).

2b. *Crotalaria nitens* HBK var. *gracilis* Windler, *Phytologia* 21: 263. 1971. Figure 2, Map 1.

Type: Mexico: Jalisco; Sierra de Halo, logging road 7 miles south southwest of Tecalitlan and extending southeast toward San Isidaro, 13-16 miles from highway. *McVaugh & Koelz* 1188 (MICH).

3. *Crotalaria brevipedunculata* Windler, *Phytologia* 21: 257. 1971.

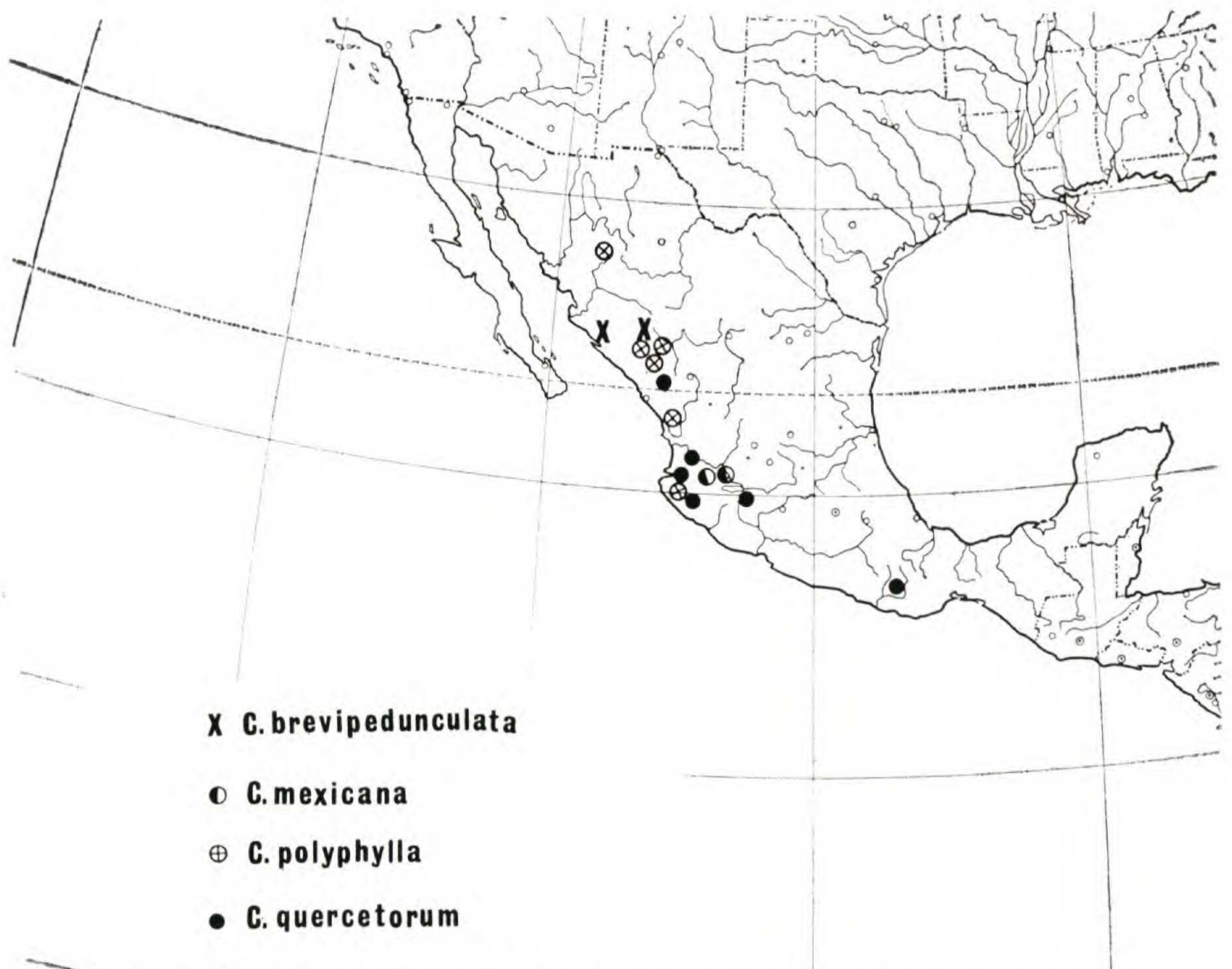
Shrub or suffrutescent herb with root type unknown. Stems more than 3 dm. long, 3.5 mm. thick, the longest internode 1.2 cm. long; vestiture of dense, short spreading trichomes 0.6-0.7 mm. long. Stipules absent. Leaves elliptic or elliptic-oblong, 2.1-4.4 cm. long, 5-13.5 mm. wide, base cuneate to widely acute, the apex acuminate; vestiture of loosely appressed trichomes 0.5-0.9 mm. long; petioles 1.6-2.1 mm. long. Inflorescences terminal and also leaf-opposed, peduncles 1.2-6.1 cm. long. Bracts sessile, linear or narrowly lanceolate, 4-4.4 mm. long, 0.3-0.6 mm. wide; pedicels 3.8-4.2 mm. long. Calyces 10.5-11 mm. long, the tubes 2.5 mm. long, bearing spreading trichomes 0.5-0.7 mm. long; bracteoles linear, 3.5 mm. long, 0.2-0.3 mm. wide. Corollas yellow, the standards 10.5-11 mm. long, equaling the upper calyx lobes; elongate anthers 1.6-2 mm. long, short anthers 0.3-0.4 mm. long; style 6.4 mm. long. Fruits and seeds not known. Chromosome number: not known. Flowering date: December 20. Habitat: shady canyon slope with oaks and palms, elevation 3,500 feet. Range: Mexico: Durango, Sinaloa. Figure 3, Map 2.

Type: Sierra Tres Picos, Durango, infrequent, scattered. *Gentry* 5311 (GH).



Figure 3. *Crotalaria brevipedunculata*.

- A. Habit
- B. Stem



Map 2. Distribution of *Crotalaria brevipedunculata*, *C. mexicana*, *C. polyphylla*, and *C. quercetorum*.

Crotalaria brevipedunculata is characterized by its lack of stipules, its short terminal inflorescences and small flowers. It most nearly resembles *C. nitens*, but differs from it in its smaller flower size and shorter peduncles.

In addition to the holotype only one other collection of this species has been observed: **Mexico**. SINALOA: Puerto a Tamiapa, *Gentry* 5815 (MICH, NY).

4. ***Crotalaria polyphylla*** Riley, *Kew Bulletin* 43: 333. 1923.

Perennial decumbent or ascending herb with a taproot to 1.4 cm. thick. Stems 4-10, 1.2-3 dm. long, 1-2.5 mm. thick, the longest internode 1-3.2 cm. long; vestiture of short appressed or long spreading trichomes, the appressed 0.3-0.6 mm. long, the spreading 0.8-1.2 mm. long. Stipules

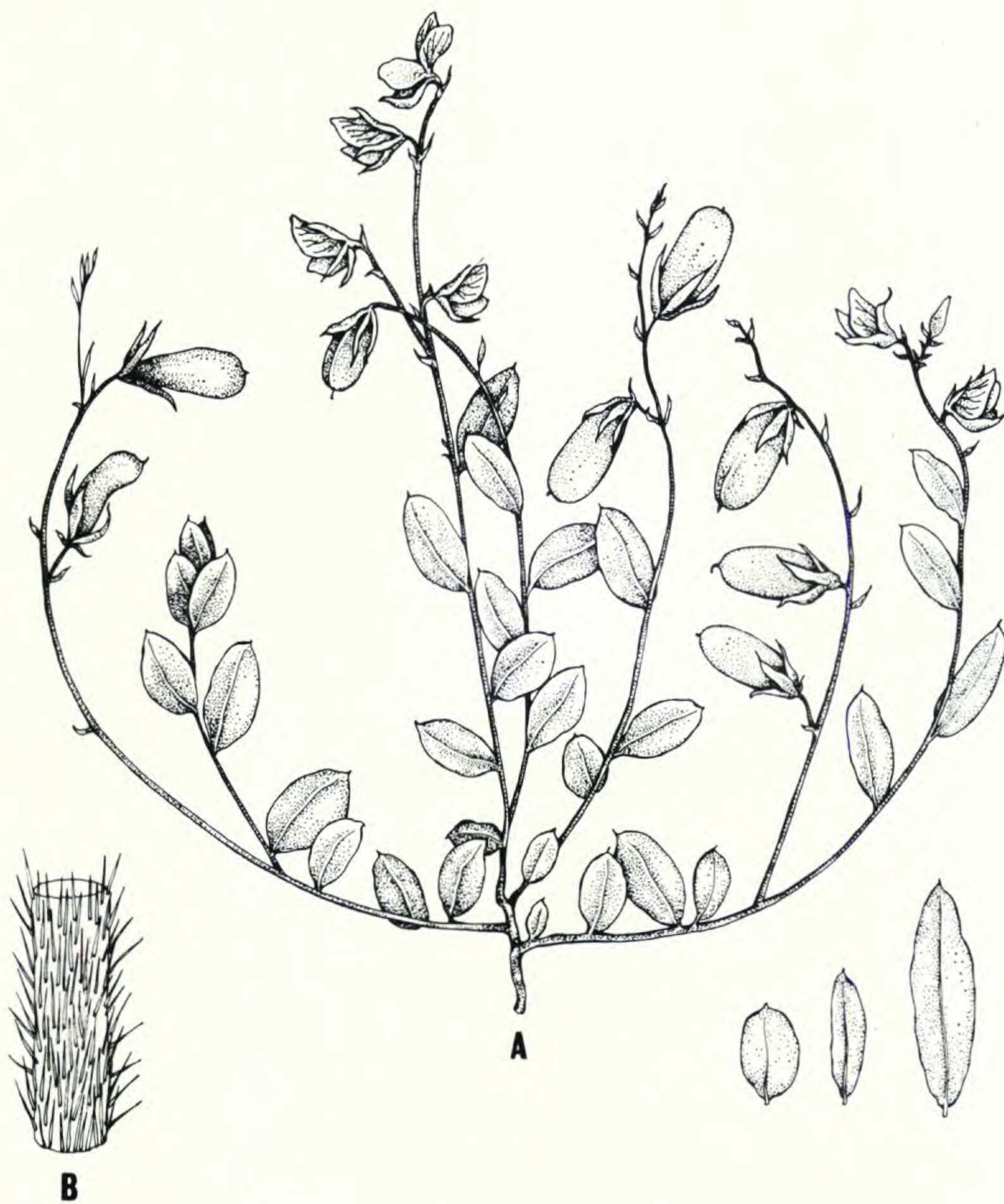


Figure 4. *Crotalaria polyphylla*.

- A. Habit and leaf variation
- B. Stem

absent. Leaves elliptic, oval, or elliptic-oblong, 1.6-4.2 cm. long, 5-13 mm. wide, base rounded to cuneate, the apex obtuse, rounded, or acuminate; vestiture of both surfaces of loosely appressed trichomes 0.5-1.1 mm. long; petioles 1-2.5 mm. long. Inflorescences terminal or terminal and also leaf-opposed, peduncles 4-16 cm. long. Bracts sessile, narrowly elliptic to narrowly lanceolate, 2.5-9.5 mm. long, 0.3-1.4 mm. wide; pedicels 4-6 mm. long. Calyces 9-13.5 mm. long, the tubes 2-3 mm. long, bearing appressed trichomes 0.3-1 mm. long; bracteoles linear, narrowly lanceolate or narrowly elliptic, 3-7 mm. long, 0.4-1 mm. wide. Corollas yellow, the standards 10-14 mm. long, 0.5-1.5 mm. longer than the upper calyx lobes; elongate anthers 1.7-2.3 mm. long, short anthers 0.5-0.7 mm. long; styles 6-7.3 mm. long. Fruits 1.4-2.4 cm. long, 0.5-0.9 cm. broad; seeds green, grey-green, green-brown, brown, or tan, 7-18 per pod, 1.8-2.5 mm. long. Chromosome number $n=16$. Flowering time: June-October. Habitat: slopes in open pine woods, elevation 6,500-9,500 feet. Range: Mexico: Chihuahua, Durango, Jalisco, Sinaloa. Figure 4, Map 2.

Type: Mexico: Sierra Madre, Seeman 2187 (K!).

Material here treated as *Crotalaria polyphylla* was included by Senn (1939) in *C. maritima* var. *maritima*; however, its terminal inflorescences and complete lack of stipules clearly separate it from *C. rotundifolia* (for treatment of Senn's *C. maritima*, see *C. rotundifolia* var. *rotundifolia*). The epithet *polyphylla* was used by Senn as the varietal name for Mexican plants he considered to be *C. purshii* (*C. purshii* var. *polyphylla*). Personal examination of the type has led to the recognition of *C. polyphylla* at the specific level. (For treatment of plants previously placed in *C. purshii* var. *polyphylla* by Senn see *C. quercetorum*.) *Crotalaria polyphylla* is characterized by its decumbent or ascending habit, lack of stipules, and terminal inflorescences.

REPRESENTATIVE SPECIMENS: MEXICO. CHIHUAHUA: Memelichi, Rio Mayo, pine slopes, Standley 2701 (GH, MEXU, US). DURANGO:

32.7 mi. W of Durango in allano slope below pine forest, 8,500 ft., *Johnston* 2694 (MEXU, MICH). JALISCO: Sierra de la Campana, along road to Mascota, 1,900-2,000 m., *McVaugh* 13777 (MEXU, MICH, US). SINALOA: Ocurahui, Sierra Surotato, *Gentry* 6227 (MICH, NY).

5. *Crotalaria stipularia* Desvaux, J. Bot. (Desvaux) 3: 76. 1814.

Crotalaria espadilla HBK. Nov. Gen. et Sp. Plantarum 6: 399. 1824. Type: *Humboldt* 1025, (P; observed IDC Microfiche).

Crotalaria stipularia var. *serpyllifolia* DC., Prodrumus 2: 124. 1825. Type: (G; observed IDC Microfiche in Prodrumus Herbarium).

Crotalaria stipularis, orthographic error by Grisebach, Flora Brit. West Ind. Isl. 178. 1864.

Crotalaria stipularis var. *oblongata* Grisebach, Flora Brit. West Ind. Isl. 178. 1864.

Crotalaria stipularis var. *sericea* Grisebach, Flora Brit. West Ind. Isl. 178. 1864.

Crotalaria stipularis var. *espadilla* Kuntze, Revisio Generum Plantarum 1: 175, 1891.

Crotalaria stipularia forma *eliptica* Chodat & Hassler, 4: 835. 1904.

Crotalaria stipularia var. *grandifolia* Senn, Rhodora 41: 333. 1939. Type: *Hahn* 239 (GH).

Annual, erect herb with a taproot to 0.6 cm. thick. Stem solitary, 1-6.3 dm. long, 1.2-5 mm. thick, the longest internode 3-8 cm. long; vestiture of loose appressed and/or spreading trichomes, 0.5-3 mm. long. Stipules present, decurrent the length of the internode, 1.1-3.2 cm. wide at the top, tapering to the subtending node, the stipule lobes incurved 1.2-1.6 cm. long. Leaves oval, oblong, elliptic, or lanceolate, 2.2-8.2 cm. long, 7.5-25 (-37) mm. wide, base rounded to cuneate, the apex retuse, rounded, acuminate, or acute; vestiture of both surfaces of appressed or loosely appressed trichomes 0.5-2.1 mm. long; petioles 0.5-1.5 mm. long. Inflorescences leaf-opposed, peduncles 3.1-10 cm. long. Bracts petiolate, elliptic, lanceolate to linear, the petioles

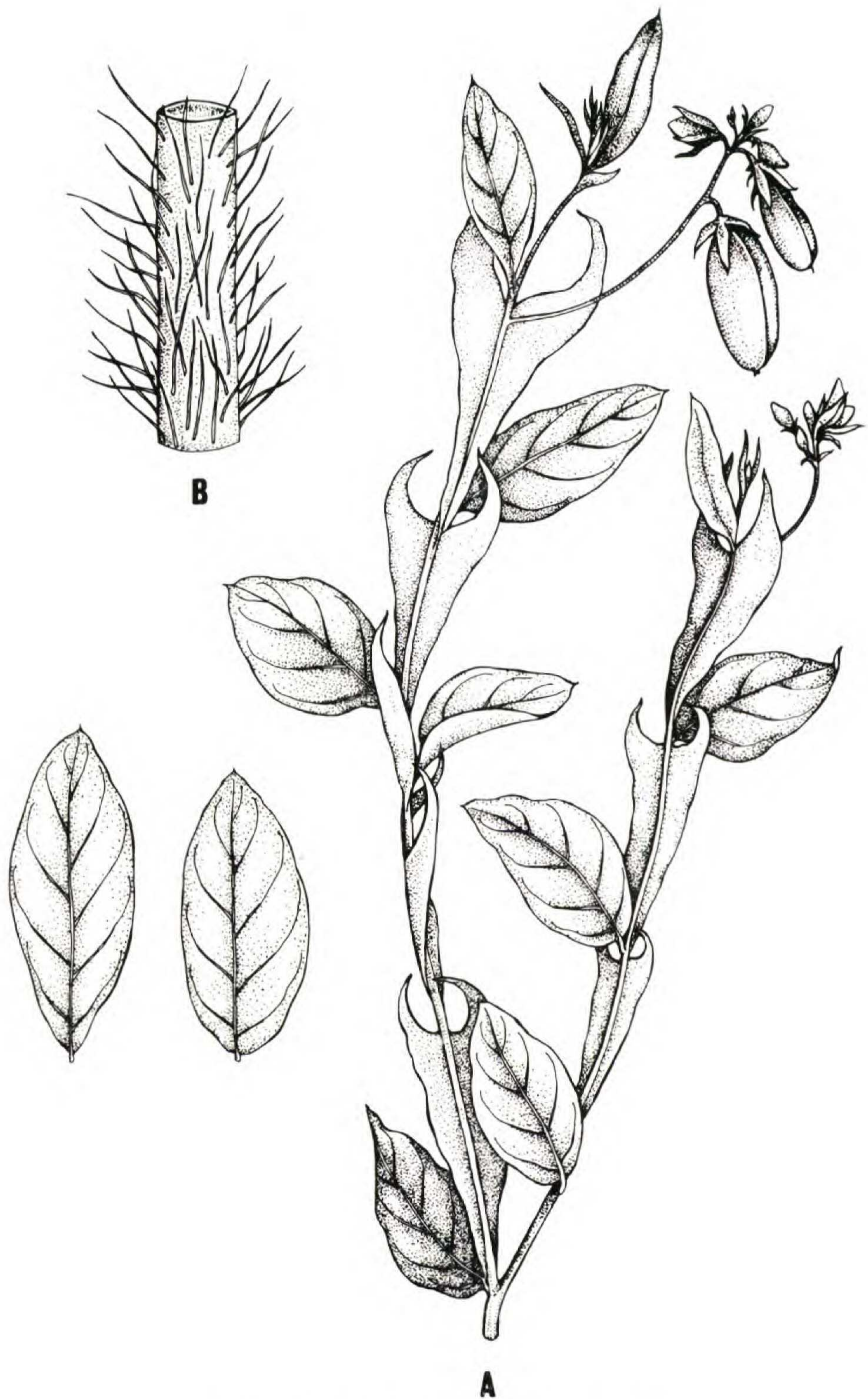


Figure 5. *Crotalaria stipularia*.
A. Habit and leaf variation
B. Stem

1-1.6 mm. long, the blades 3-5 mm. long, 0.3-1.2 mm. wide; pedicels 2-4 mm. long. Calyces 8-10 mm. long, the tubes 2-2.8 mm. long, bearing appressed or loosely appressed trichomes 0.7-1.2 mm. long; bracteoles elliptic, lanceolate, or linear, 3-4.5 mm. long, 0.4-0.7 mm. wide. Corollas yellow, the standards 6-10 mm. long, equaling to 1.5 mm. shorter than the upper calyx lobes; elongate anthers 1.1-1.3 mm. long, short anthers 0.3-0.5 mm. long; styles 4.5-5.2 mm. long. Fruits 2.5-3.3 cm. long, width not known; seeds tan, bronze, red-brown, or dark brown, 17-41 per pod, 2-3 mm. long. Chromosome number: $n=16$. Flowering time: February-December. Habitat: sandy soils, savannahs, clearings, fields and roadsides, elevations to 2,300 feet. Range: West Indies; Dominican Republic, Dominica, Guadeloupe, Haiti, Martinique, Puerto Rico, Trinidad. (Also widely distributed in South America.) Figure 5, Map 1.

Type: Not located.

Crotalaria stipularia, as treated by Senn, was divided into three varieties. Varieties "typica" and "grandifolia" are not different except in overall plant size. Both variations are found in a single location mass collection from Puerto Rico sent to me by Dr. R. A. Howard of the Arnold Arboretum. This size variation is probably typical of plants of this species at most locations. Senn's application of De Candolle's *C. stipularia* var. *serpyllifolia* is to a plant in which all of the original leaves were lost during drought (or some other catastrophe) and new branches with small leaves and shorter internodes had developed before the plant was collected. The wide decurrent stipules were not lost when the leaves were lost, which accounts for the variety having large stipules. The IDC Microfiche photograph of De Candolle's specimen in the Prodrum Herbarium shows a plant with smaller leaves, but not quite so small as those in Senn's cited specimens. No field collections were made of *C. stipularia* during this study, but seeds were obtained for garden studies (*Irwin* 1050 and *Stimson* 4264).

Crotalaria stipularia is characterized by its erect habit, leaf-opposed inflorescences, small flowers, and large stipules with incurved lobes. It most nearly resembles *C. sagittalis*, but the two taxa may be separated by stipule characters.

REPRESENTATIVE SPECIMENS: DOMINICA. Grand Savannah, *Lloyd* 835 (NY). DOMINICAN REPUBLIC. Prov. de la Vega: near Garabawa at Rio Yaquir, *Fuertes* 1669 (A, NY, P). GUADELOUPE. Montebello, alt. 50 m., *Questel* 432 (P, US). HAITI. Dept. du Nord: east of Marmelade, grassy summit of mountain, *Leonard* 7222 (US). MARTINIQUE. Fort Vaillant, *Hahn* 239 (GH; Photo., US). PUERTO RICO. Along railroad N of Mayaguez, *Heller* 4574 (MICH, NY, US). ST. VINCENT. near Barrovollic (Leeward), *Smith & Smith* 1053 (NY). TRINIDAD. south of Dabadie, *Bulton & Hazen* 702 (GH).

6. *Crotalaria sagittalis* L., Sp. Pl. p. 714. 1753.

Crotalaria fruticosa Miller, Gard. Dict. (pages not numbered) 1768. Type: Jamaica, *Houstoun*, (BM, photo., NCU).

Anonymos sagittalis (L.) Walt., Flora Carol. 181. 1788. Type: same as for *C. sagittalis* L.

Crotalaria parviflora Roth, Catalecta Bot. 1: 83. 1797. Type: not located.

Crotalaria sagittalis var. β *oblonga* Michx. Flora Boreali-Am. 2: 55. 1803. Type locality: "Virginia et Carolina".

Crotalaria platycarpa Link, Enum. Pl. Hort. Reg. Bot. Berol. Alt. part 2, 227. 1822. Type: destroyed in Berlin.

Crotalaria pringlei A. Gray, Proc. Am. Acad. 17: 200. 1881-2. Type: Arizona, *Pringle*, summer 1881 (GH).

Crotalaria sagittalis var. *fruticosa* (Miller) Fawcett and Rendle, Fl. Jamaica 4: 10. 1920.

Crotalaria sagittalis var. *blumeriana* Senn, Rhodora 41: 339. 1939. Type: *Blumer* 1772 (GH).

Crotalaria tuerckheimii Senn, Rhodora 41: 339. 1939. Type: *von Tuerckheim II* 1282 (GH).

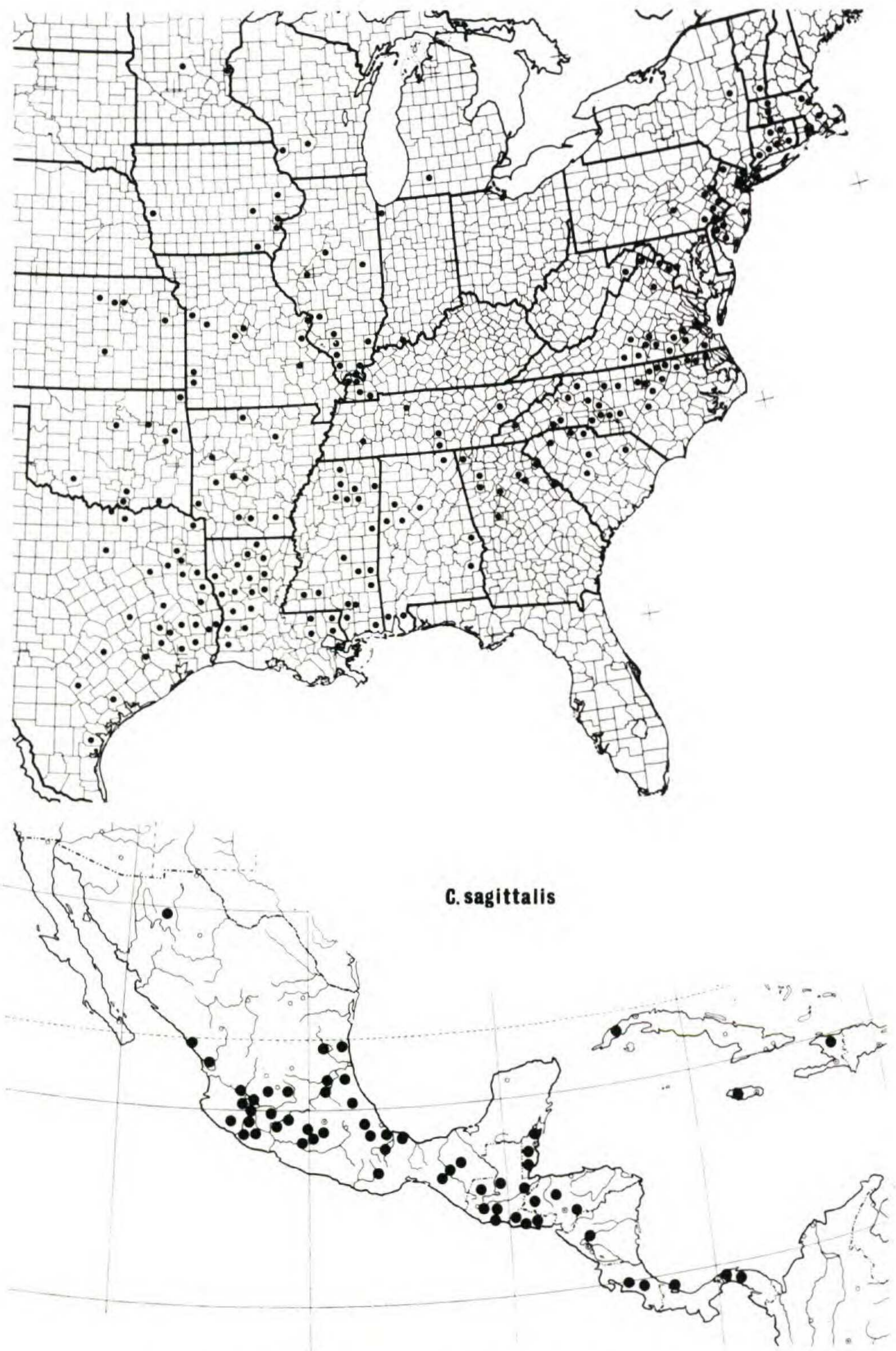
Crotalaria belizensis Lundell, Amer. Midl. Naturalist 29: 473. 1943. Type: *Gentle* 4144 at (NY).

Annual or rarely perennial, erect herb with a taproot to 0.6 cm. thick. Stems 1 (-7), 0.25-4.1 dm. long, 1-2.5 mm. thick, the longest internode 0.4-4.2 cm. long; vestiture of long spreading trichomes, 1.5-3 mm. long. Stipules present,



Figure 6. *Crotalaria sagittalis*.

- A. Habit and leaf variation
- B. Stem



Map 3. Distribution of *Crotalaria sagittalis*.

decurrent from $\frac{1}{2}$ to the full length of the internode, 0.35-1.7 cm. wide at the top, tapering to the subtending node, the stipule lobes spreading 0.4-1.8 cm. long. Leaves elliptic, oblong, lanceolate, or linear-lanceolate, 1.1-10 cm. long, 2.5-15 (22.5) mm. wide, base rounded to cuneate, the apex obtuse, mucronate, acuminate, or acute; vestiture of both surfaces of spreading or loosely appressed trichomes 1-2.9 mm. long; petioles 1.2-2.5 mm. long. Inflorescences leaf-opposed, peduncles 2-8 (-12) cm. long. Bracts petiolate, lanceolate to elliptic lanceolate, the petioles 0.5-1.5 mm. long, the blades 4-8.1 mm. long, 0.5-1.3 mm. wide; pedicels 3.5-5.5 mm. long. Calyces 7-15 mm. long, the tubes 2.3-3.9 mm. long, bearing loosely appressed trichomes 0.8-2 mm. long; bracteoles elliptic lanceolate, lanceolate, or linear, 2.5-7 mm. long, 0.7-1.2 mm. wide. Corollas yellow, the standards 6-12.5 mm. long, equaling to 4 mm. shorter than the upper calyx lobes; elongate anthers 0.9-2 mm. long, short anthers 0.3-0.5 mm. long; styles 4-5.3 mm. long. Fruits 1-2.7 (3.6) cm. long, 0.5-1.1 cm. broad; seeds tan, tan-green, olive, green-brown, or coffee-brown, 7-32 per pod, 1.4-3 mm. long. Chromosome number: $n=16$. Flowering time: May-October. Habitat: road and railroad rights-of-way, disturbed ground, sand deposits, fields, prairies, lake margins, and dry oak and pine forests, elevation sea level — 8,500 feet. Range: Eastern and Central United States through Mexico and Central America to Panama and on the Greater Antilles. Figure 6, Map 3.

Lectotype: "2 Kalm sagittalis" (LINN) (see Taxon 21: 545.)

Type locality: "Brasilia, Virginia" as cited in Species Plantarum.

Plants included here under *Crotalaria sagittalis* include material cited by Senn as variety *blumeriana* and variety *fruticosa*, as well as Senn's variety "typica". Early leaves of plants of *C. sagittalis* tend to be broader than the later leaves, and all branches tend to have narrower leaves than the main stem. In addition, the further south a plant occurs, the longer the plant grows, and the more early leaves are

lost before the end of the growing season. There is also a tendency for southern plants to have narrower early leaves than northern plants. Garden studies have shown *Crotalaria sagittalis* var. *blumeriana* to be a dry habitat ecophene of the typical species. Although a great deal of variation exists in *C. sagittalis*, especially in the Mexican representatives, little in the way of a clear pattern that would allow a useful segregation of the plants (and populations) into varieties has been detected. Further study of this wide-spread but poorly understood species, to gain a more complete picture of the relationships between plant variation, geographic, and ecological factors, may prove helpful, especially in Mexico, Central and South America.

REPRESENTATIVE SPECIMENS: BRITISH HONDURAS. Honey Camp, *Lundell* 665 (US). COSTA RICA. Paturage a San Jose de Costa Rica, *Tonduz* 443 (MICH, P). CUBA. Pinar del Rio: Herradura, *Britton, Britton, Earle, & Gager* 6404 (NY). GUATEMALA. Alta Verpaz: Coban, alt. 4,300 ft., *Tuerckheim* 239 (GH, US). HAITI. Massif de la Selle Nouvelle Touraine, alt. 1,400 m., *Ekman* 1501 (NY, US). HONDURAS. Morazan, hills around Zamorano Valley, alt. 800-900 m., *Swallen* 11252, (US). JAMAICA. Castleton, 490 ft., *Harris* 11855 (GH, NY, P, US). NICARAGUA. Comarca ElCabo: LaTronquera, alt. 60 m., *Molina* 14881 (NY). PANAMA. Panama: Sabana de Dormisolo, near Chepo, *Pittier* 4686 (US). EL SALVADOR. Ahuachapan: Ahuachapan, alt. 800-1,000 m., *Standley* 19747 (GH, NY, US). MEXICO. Baja California: S side of La Carrerita, Sierra El Taste, 1,500-1,600 m., *Carter & Chisaka* 3504 (MEXU). Chiapas: Tenejapa, 7,800 ft., *Breedlove* 12713 (US). Chihuahua: Madera, *Pennell* 19228 (US). Colima: Colima, *Palmer* 130 (US). Durango: without locality, *Garcia* 942 (US). Guanajuato: NE of Guanajuato, *Ripley & Barneby* 13351 (NY). Jalisco: near Chapala, *Rose & Painter* 7636 (NY). Mexico: Puerto del Salitre, 1,300 m., *Hinton* 1780 (GH, MEXU, NY). Michoacan: vicinity of Coalcoman, 1,000 m., *Hinton* 12862 (NY, US). Morelos: Cuernavaca, *Rose & Painter* 6850 (GH, NY, US), Nayarit: Cerro de la Cruz, E of Tepic, *Mexia* 669 (GH). Oaxaca: near city of Oaxaca, *Rose & Hough* 4623 (NY, US). Puebla: 72 km. SE of Mexico City, *Weaver* 995 (US). San Luis Potosi: 7-8 mi. NE of Xilitla, *King* 4360 (US). Sinaloa: near Mazatlan, *Windler & Windler* 2885 (NCU). Sonora: NE of El Tigre, 6,000 ft., *White* 4370 (GH, MICH). Tamaulipas: vicinity of Gomez Farias, ca. 350 m., *Palmer* 341 (US). Veracruz: SE of Cate-maco, meadow, *Dressler & Jones* 114 (MEXU, MICH, NY, US). UNITED

STATES. **Alabama:** MOBILE CO.: Dauphin Island, *Jones* 585 (ALA). **Arkansas:** SALINE CO.: ridges, Benton, *Demaree* 37333 (SIU). **Connecticut:** MIDDLESEX CO.: Middlefield, *Kofoid* (GH). **Georgia:** JACKSON CO.: 11 mi. N of Athens, *Cronquist* 4571 (GH). **Illinois:** JACKSON CO.: roadside S of Elkhville, *Bailey & Swayne* 462 (SIU, NCU). **Indiana:** LAKE CO.: East Gary, *Hull* 18 July 1936 (GH). **Iowa:** JONES CO.: railroad right-of way, Sect. 7, Oxford Twp., *Isely* 5913 (GA). **Kansas:** RILEY CO.: ravines, *Norton* 80 (GH, P). **Kentucky:** GRAVES CO.: railroad embankment, Fancy Farm, *O'Dell & Windler* 936 (SIU). **Louisiana:** CALCASIEU PARISH: 1½ miles NNW of Starks, Sect. 26, *Las-seigne* 1579 (LAF). **Maryland:** Montgomery?, Wildwood, *Dowell* 1626 (GH). **Massachusetts:** MIDDLESEX CO.: shore of Winter Pond, *Bartlett* 224 (GA, GH, TEX, WIS). **Michigan:** KALAMAZOO CO.: 1 mi. E of Schoolcraft, *Hanes* 1796 (GH). **Minnesota:** CHISAGO CO.: Lindstrom, *Anderson* 6458 (GH, WIS). **Mississippi:** LAYAYETTE CO.: near Tula Cemetery, 18 mi. SE of Oxford, *Pullen* 64294 (GA, MISS, NCU). **Missouri:** BARTON CO.: prairies, Milford, elev. 750 ft., *Demaree* 39377 (GA, NCU, USF). **New Jersey:** BERGEN CO.: Hackensack, route 4, sandy field, *Rush & Svenson* 6769 (GH, WIS). **New York:** SARATOGA CO.: N of Crescent, *Burnham* 8 Sept. 1906 (GH). **North Carolina:** CALDWELL CO.: 1 mi. SE of Hudson, *Randolph & Randolph* 1096 (GH, NCU). **Oklahoma:** MUSKOGEE CO.: 2 mi. S of Braggs, *Edmond* 164 (TEX). **Pennsylvania:** DELAWARE CO.: Wayne, dry gravel bank, *Bartram* 1162 (GH). **Rhode Island:** Cumberland (?) without collection name & number, *Aug. 1840* (GH). **South Carolina:** GREENVILLE CO.: 2½ mi. SW of Berry's Pond, *Freeman* 56577A (NCU). **Tennessee:** KNOX CO.: sandy soil near Knoxville, *Ruth* 661 (WIS). **Texas:** JASPER CO.: 3 mi. N of Evadale, *Turner & Tharp* 3079 (TEX). **Vermont:** WINDHAM CO.: Vernon, *Blanchard* 1901 (GH). **Virginia:** CULPEPER CO.: 0.3 mi. N of Lakota on Co. Rt. 621, *Ahles & James* 61692 (NCU). **West Virginia:** HARDY CO.: Lost River Bridge, wasteground, *Core* 18 Aug. 1931 (GH).

7. *Crotalaria purshii* DC., Prodrumus 2: 124. 1825.

Crotalaria sagittalis var. β L. Sp. Pl. 714. 1753.

Crotalaria sagittalis var. α *linearis* Michx., Fl. Boreali-Am. 2: 55. 1803. Type locality: "Virginia et Carolina".

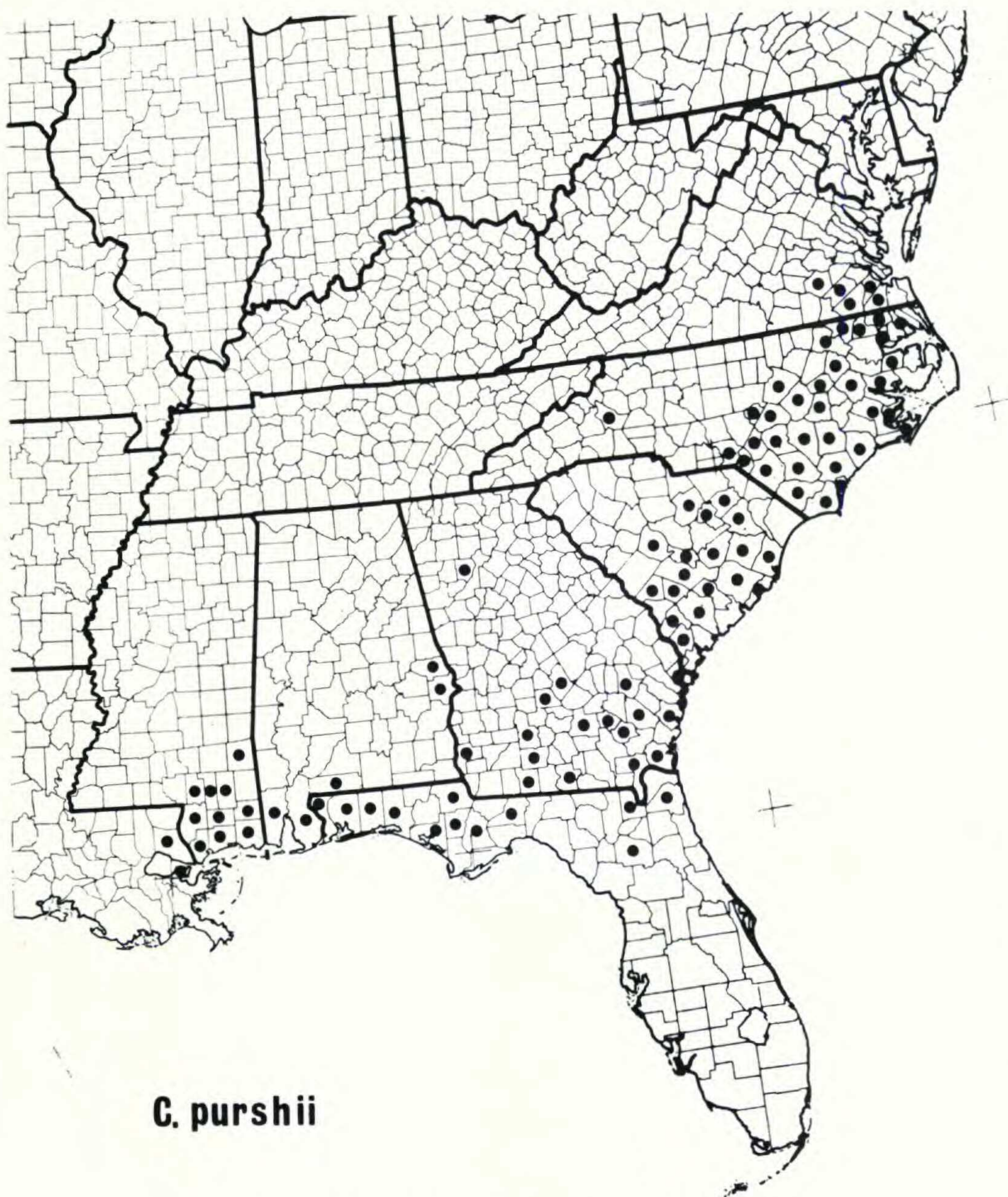
Crotalaria laevigata Pursh, Fl. Am. Sept. 469, non Lam., Encyc., 2: 198. 1786. Type: Pursh specimen not located; Syntype was plate in Plukenet, Phytographia-Amagestum Bot. t. 277, fig. 2. 1694. Specimen from which this figure was drawn is in Sloane collection at BM.

Perennial, erect herb with a taproot to 0.7 cm. thick.



Figure 7. *Crotalaria purshii*.

- A. Habit and leaf variation
- B. Stem



Map 4. Distribution of *Crotalaria purshii*.

Stems 1-4 (8), 1.5-5 dm. long, 1-1.5 mm. thick, the longest internode 3.3-8.5 cm. long; vestiture of short appressed or loosely appressed trichomes 0.4-0.8 mm. long. Stipules present, decurrent one-half to the full length of the internode, 0.3-0.9 cm. wide at the top tapering to the base, the stipule lobes spreading 0.5-1.7 cm. long. Leaves linear, oblong, linear-lanceolate or elliptic, 4.9-10 cm. long, 1.7-12 mm. wide, base rounded to cuneate, the apex obtuse or acute; the lower surface bearing appressed trichomes 0.3-0.7 mm. long, the upper surface glabrous; petioles 0.5-2 mm. long. Inflorescences leaf-opposed, peduncles 7.5-23 cm. long. Bracts petiolate, elliptic-lanceolate to lanceolate, the petioles 0.5-1.6 mm. long, the blades 4.5-7 (8.5) mm. long, 0.6-1.8 (2) mm. wide; pedicels 4.5-6 mm. long. Calyces 9-12.5 mm. long, the tubes 2.5-3.5 mm. long, bearing appressed trichomes 0.2-0.5 mm. long; bracteoles lanceolate or elliptic-lanceolate, 3.5-5 mm. long, 0.8-1.2 mm. wide. Corollas yellow, the standards 8-13.5 mm. long, 2 mm. shorter to 0.5 mm. longer than the upper calyx lobes; elongate anthers 1.2-1.6 mm. long, short anthers 0.3-0.6 mm. long; styles 2.7-4.6 mm. long. Fruits 1.4-2.8 cm. long, 0.6-1 cm. broad; seeds tan, olive, green-brown, or dark brown, 11-37 per pod, 1.8-2.9 mm. long. Chromosome number: $n=16$. Flowering time: March-October. Habitat: savannahs, sandhills, and open pine woods, coastal plain. Range: United States: Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Virginia. Figure 7, Map 4.

Type: Based on *Crotalaria laevigata* Pursh.

Type locality: Pine woods of Virginia and Carolina.

Crotalaria purshii, named by De Candolle, was based on material from Virginia and Carolina. He cites *C. laevigata* of Pursh as being the same, but proposes the name *C. purshii* since *C. laevigata* had been previously used by Lamarck. *Crotalaria sagittalis* var. β L. is based on Plukenet's figure (Plukenet, 1694, *t.* 277, *Fig.* 2) which is *purshii*.

Senn (1939) recognized a variety, *polyphylla*, under

Crotalaria purshii. Most specimens of this variety are here treated as *C. quercetorum*. For further information concerning the epithet *polyphylla* see the discussion under *C. polyphylla*.

Crotalaria purshii is characterized by its erect habit; sparse, short, appressed pubescence; spreading stipule lobes; frequently narrow leaves, the upper surfaces of which are glabrous; and long peduncles. *Crotalaria purshii* is similar to *C. sagittalis* in habit and general appearance in parts of its range, but it may be distinguished from *C. sagittalis* by its glabrous upper leaf surfaces, appressed pubescence, and long peduncles. The extremely variable *C. rotundifolia* var. *rotundifolia* may occasionally bear a resemblance to *C. purshii*, but these plants lack glabrous upper leaf surfaces.

REPRESENTATIVE SPECIMENS: UNITED STATES. **Alabama:** BALDWIN CO.: sandy field, *Jones* 496 (AUA). **Florida:** CALHOUN CO.: Cypress Park, Dead Lakes, *Godfrey & Clewell* 62916 (LAF). **Georgia:** WAYNE CO.: open pinelands, 5 mi. S. of Jessup, *Duncan* 6941 (GA). **Louisiana:** ST. TAMMANY PARISH: 7¾ mi. S of town of Pearl River, Sect. 13, *Lasseigne* 1480 (LAF). **Mississippi:** PEARL RIVER CO.: 1 mile N of Picayune along Hwy. 12, low pine lands, *Bollwinkel & Wunderlin* 9 (SIU). **North Carolina:** CRAVEN CO.: pine savannah, 0.6 mi. SW of Havelock, *Radford* 34504 (NCU). **Virginia:** ISLE OF WIGHT CO.: dry sandy pine and oak woods ca. 1 mile SE of Zuni, *Fernald & Long* 6233 (GH).

8. *Crotalaria quercetorum* Brandegee, U. Cal. Pub. Bot. 10: 407. 1924.

Crotalaria purshii var. *polyphylla* (Riley) Senn, *Rhodora* 41: 346. 1939. (see note below)

Annual, erect, or ascending herb with a slender taproot to 0.25 cm. thick. Stem solitary, 1.1-5.3 dm. long, 1-3.1 mm. thick, the longest internode 1.3-5.2 cm. long; vestiture of short appressed trichomes, 0.3-0.4 mm. long. Stipules usually absent or very narrow, decurrent 1/5 the length of the internode, 0.3-0.4 cm. wide at the top narrowing to the base, the stipule lobes spreading 0.1-0.25 cm. long. Leaves elliptic, narrowly oblong, narrowly elliptic, narrowly lanceo-

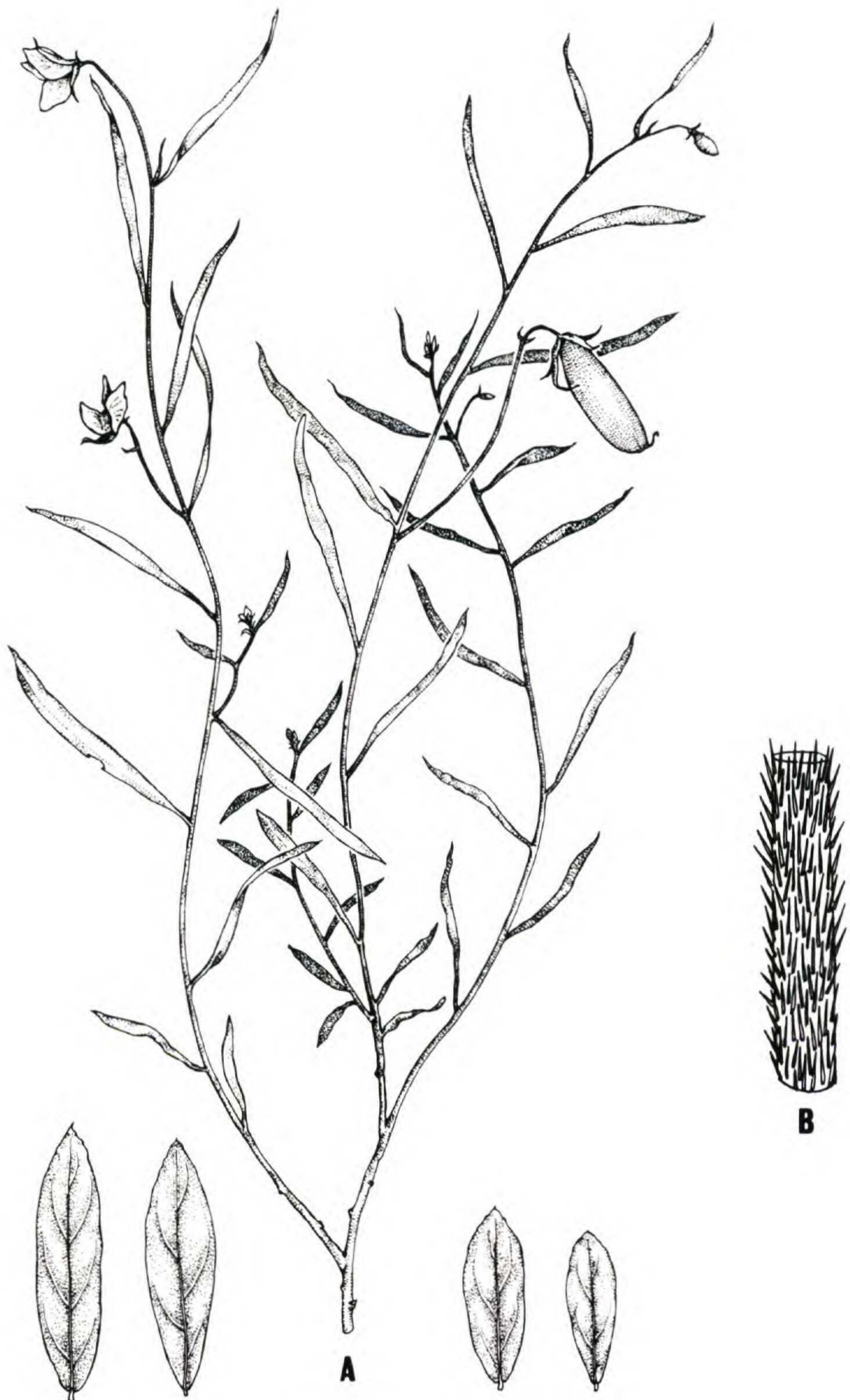


Figure 8. *Crotalaria quercetorum*.
A. Habit and leaf variation
B. Stem

late, or linear, 3-6.8 cm. long, 2-5.5 (-8) mm. wide, base rounded to cuneate, the apex acute or acuminate; vestiture of appressed trichomes 0.2-0.5 mm. long, the upper surface usually glabrous; petioles 1.5-3 mm. long. Inflorescences leaf-opposed, peduncles 2.5-8 cm. long. Bracts sessile, narrowly elliptic, or linear, 2.5-3.5 mm. long, 0.2-0.3 mm. wide; pedicels 2.5-4.2 mm. long. Calyces 8.2-11 mm. long, the tubes 1.5-2 mm. long, bearing appressed trichomes 0.2-0.3 mm. long; bracteoles linear or narrowly elliptic, 1.5-3.5 mm. long, 0.2-0.3 mm. wide. Corollas yellow, the standards 7.5-10.5 mm. long, equaling to 2 mm. shorter than the upper calyx lobes; elongate anthers 0.8-1.4 mm. long, short anthers 0.2-0.3 mm. long; styles 3.5-3.6 mm. long. Fruits 1-2.4 cm. long, 0.4-0.7 cm. broad; seeds olive, green-brown, or brown, 24-30 per pod, 1.4-2 mm. long. Chromosome number: $n=16$. Flowering time: August-March. Habitat: ridges and slopes in oak, oak-pine, and pine woods, elevation 2,600-7,000 feet. Range: Mexico: Chiapas, Jalisco, Michoacan, Nayarit, Oaxaca, Sinaloa. Figure 8. Map 2.

Type: Mexico: Chiapas: Hacienda Monserrate, *Purpus* 9144 (UC!).

Crotalaria quercetorum was included under *C. purshii* by Senn. Unfortunately, Senn chose to use the epithet *polyphylla* for what he recognized as a variety of *C. purshii*. Examination of the type of *C. polyphylla* Riley leads to the conclusion that the name is erroneously applied to the material here treated as *C. quercetorum*. The holotype of *C. quercetorum* is a mixed sheet with one specimen present which may be interpreted as intermediate between *C. quercetorum* and *C. sagittalis*. The isotype (US) examined is also composed of several elements, but all are referable to *C. quercetorum*.

Crotalaria quercetorum is characterized by its short appressed pubescence, lack or near lack of stipules, usually narrow foliage, short peduncles and small flowers. *Crotalaria quercetorum* is similar to *C. purshii* but may be distinguished by its much shorter peduncles and its usually

smaller size. Because a number of specimens with intermediate morphology have been collected, hybridization between *C. quercetorum* and *C. sagittalis* is suspected in parts of their range where they are sympatric. *Windler & Windler 2994* (NCU) is a collection in which some specimens seem to reflect this putative hybridization.

REPRESENTATIVE SPECIMENS: GUATEMALA. Exact locality not given, *Bernoulli 282* (G). MEXICO. CHIAPAS: Hacienda Monserate, *Purpus 9144* (UC, US); Jalisco: 15-20 mi. SE of Autlan-Sierra Manantlan ca. 1,700 ft., *McVaugh 13973* (MICH); Michoacan: 32 mi. W of Jiquilpan along road to Manzanillo, 7,000 ft., *Fearing 1195* (TEX); Nayarit: 1 mi. from town of Santa Maria del Oro on way to Laguna Santa Maria, 3,700 ft., *Windler & Windler 2917* (NCU); Oaxaca: 5-6 Km NE of Putla, 350 m., *McVaugh 22248* (MICH); Sinaloa: Puerto a Tamiapa, 4,500 ft., *Gentry 5815* (MEXU).

9. *Crotalaria mexicana* Windler, *Phytologia* 21: 259. 1971.

Crotalaria sagittalis var. *fruticosa* (Miller) Fawcett and Rendle, 4: 10, 1920, pro parte, sensu Senn, non sensu typus.

Annual erect herb with a slender taproot to 0.3 cm. thick. Stems solitary, 1.2-2.3 dm. long, 1.6-2.4 mm. thick, the longest internode 1-1.5 cm. long; vestiture of dense, appressed trichomes, 1.2-2.5 mm. long. Stipules absent. Leaves narrowly elliptic, linear-lanceolate or linear, 2.2-4.6 cm. long, 4-8 mm. wide, base rounded to cuneate, the apex rounded, acute or acuminate; vestiture of both surfaces of dense, loosely appressed trichomes 1.1-2.1 mm. long; petioles 0.5-0.6 mm. long. Inflorescences leaf-opposed, peduncles 0.8-2 cm. long. Bracts sessile, lanceolate, 3.3-3.6 mm. long, 0.7-0.8 mm. wide; pedicels 2.5-4 mm. long. Calyces 10.5-11.5 mm. long, the tubes 2-2.5 mm. long, bearing loosely appressed and spreading trichomes 0.8-2 mm. long; bracteoles linear-lanceolate, 4-4.5 mm. long, 0.5-0.6 mm. wide. Corollas yellow, the standards 10-10.5 mm. long, equaling to 0.5 mm. shorter than the upper calyx lobes; elongate anthers 1.5-1.7 mm. long, short anthers 0.5-0.6 mm. long; styles 4.8-5.3 mm. long. Fruits 2.1-2.5 cm. long, 0.8-1 cm. wide; seeds brown, number per pod not known, 1.8-2 mm. long. Chromosome number: not known. Flowering time: Sep-

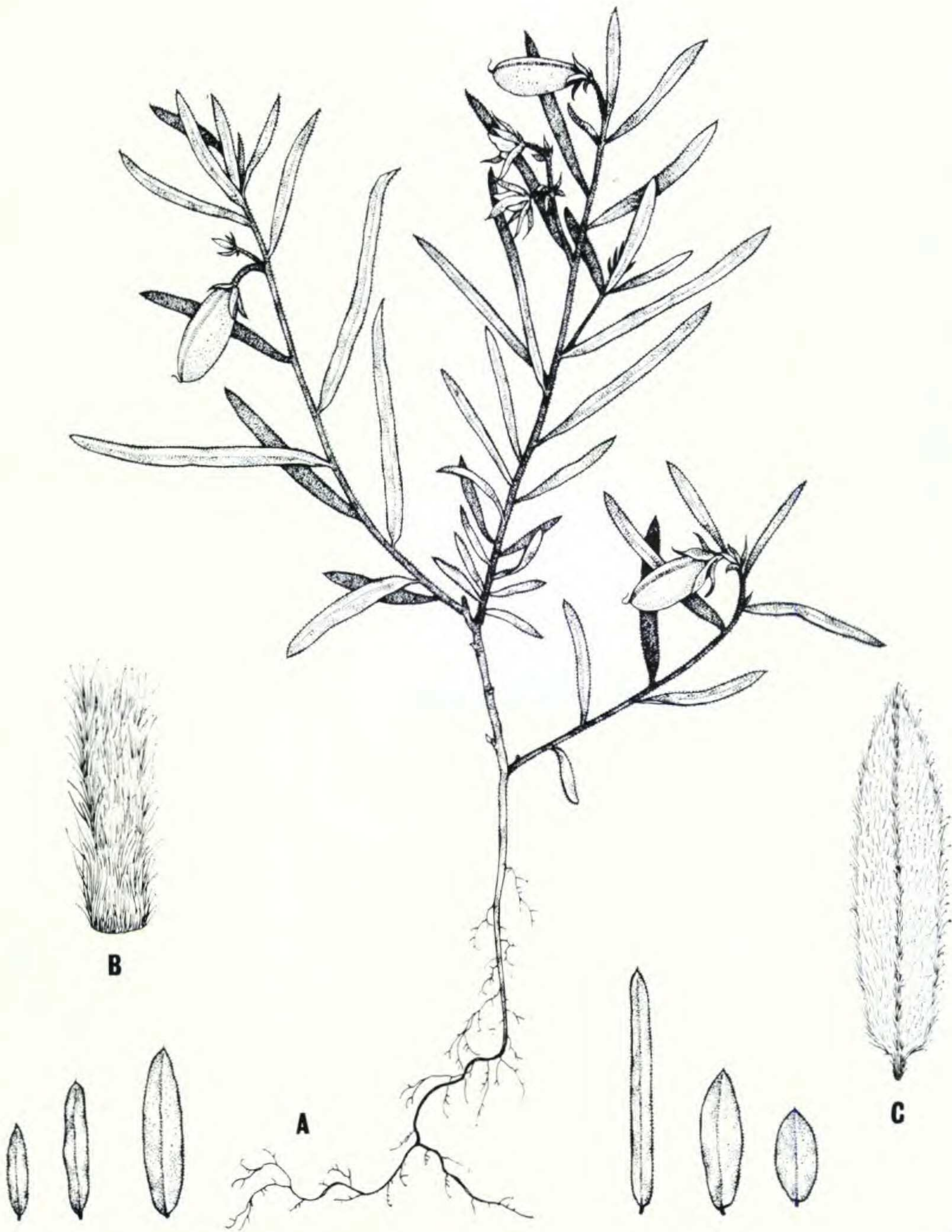


Figure 9. *Crotalaria mexicana*.

- A. Habit and leaf variation
- B. Stem
- C. Leaf pubescence

tember-October. Habitat: dry slopes of mountains, elevation ca. 6,000 ft. Range: Mexico: Jalisco. Figure 9, Map 2.

Type: Mexico: Jalisco, mountainside above Etzatlan, *Pringle* 8855 (holotype, GH; isotypes, TEX, US).

Crotalaria mexicana is a new species, the representatives of which were referred by Senn (1939) to *C. sagittalis* var. *fruiticosa* (here treated as *C. sagittalis* var. *sagittalis*). *Crotalaria mexicana* is most similar to *C. sagittalis* and *C. quercetorum*. It differs from *C. sagittalis* in its lack of stipules and absence of spreading pubescence, and from *C. quercetorum* in its short thick peduncles and in its dense pubescence. *Crotalaria mexicana* is characterized by its erect habit, dense, appressed pubescence, lack of stipules, and extremely short, leaf-opposed peduncles.

REPRESENTATIVE SPECIMENS: MEXICO. JALISCO: near Etzatlan, *Pringle* 8855 (=type), *Pringle* 11807 (GH, US), *Rose & Painter* 7571 (US); near Guadalajara, *Rose & Painter* 7469 (US).

10. ***Crotalaria rotundifolia*** (Walt.) Gmelin in Linne . . . Systema Naturae 2: 1095. 1792.

Anonymos rotundifolia Walter, Flora Caroliniana, 181. 1788. Type: BM, photo., NCU!

Crotalaria sagittalis var. *ovalis* Michx. Flora Boreali-Am. 2: 55. 1803. Type locality: "Virginia et Carolina".

Crotalaria rotundifolia Poiret, Encycl. Meth. 2: 402. 1812, non Gmelin, 1792. (see Ward, 1962).

Crotalaria ovalis (Michx.) Pursh, 469. 1814, nomen illegit.

Crotalaria hookeriana A. DC. in A.P. & A. DC., Mem. Soc. Phys. Genève 9: 97. 1841. Type: not observed.

Crotalaria leptoclona Schauer, Linnaea 20: 737. 1847. Type: Mexico, *Aschenborn* 172, not located.

Crotalaria maritima Chapman, Flora South. United States, Suppl. 614. 1883. Type: not located.

Crotalaria linaria Small, Flora SE United States 679. 1933. Type: Pine Key, Fla., *Blodgett* (NY!).

Crotalaria maritima var. *linaria* (Small) Senn, *Rhodora* 41: 347. 1939.

Crotalaria rotundifolia var. *linaria* (Small) Fernald & Schubert, *Rhodora* 50: 203. 1948.

Perennial procumbent, decumbent, or ascending herb with a taproot to 1.2 cm. thick. Stems 2-20, 0.3-6.5 dm. long, 0.5-3.1 mm. thick, the longest internode 0.6-4.8 cm. long; vestiture of appressed, loosely appressed, or spreading trichomes, appressed 0.3-0.6 mm. long, spreading 0.8-3.2 mm. long. Stipules present, with only the stipule lobes present or the stipules decurrent from $\frac{1}{4}$ to the full length of the internode, 0.13-2.3 cm. wide at the top tapering to the base, the stipule lobes spreading 0.15-1.7 cm. long. Leaves round, oval, oblong, ovate, lanceolate, elliptic, or linear, 0.9-5.5 cm. long, 1.0-33.1 mm. wide, base rounded to widely cuneate, the apex rounded, obtuse, mucronate, acuminate, or acute; vestiture of both surfaces of erect, appressed, or loosely appressed trichomes 0.3-2.8 mm. long; petioles 0.5-3 mm. long. Inflorescences leaf-opposed, peduncles 1.3-33.9 cm. long. Bracts with or without petioles, elliptic, lanceolate, or linear, the petioles to 1.5 mm. long, the blade 2-7.1 mm. long, 0.3-2 mm. wide; pedicel 2-5 mm. long. Calyces 7-14.9 mm. long; the tubes 1.5-4.5 mm. long, bearing appressed, loosely appressed or spreading trichomes 0.2-1.5 mm. long; bracteoles broadly to narrowly elliptic, lanceolate, or linear, 1.8-6.5 mm. long, 0.3-1.3 mm. wide. Corollas yellow, the standards 6-15 mm. long, 2.5 mm. shorter to 1.9 mm. longer than the upper calyx lobes; elongate anthers 0.9-2.1 mm. long, short anthers 0.3-0.7 mm. long; styles 4-6.9 mm. long. Fruits 1.2-2.8 cm. long, 0.5-1.1 cm. broad; seeds tan, bronze, green-tan, olive, green-brown, or red-brown, 12-46 per pod, 1.5-2.7 mm. long. Chromosome number: $n=16$. Flowering time: United States, January-October; Mexico, July-March. Habitat: road and railroad rights-of-way, rocky slopes, sandridges, sandhills, open pine, and pine-hardwood forests, elevation sea level — 8,250 feet. Range: Costa Rica; Guatemala; Mexico: Chihuahua, Guanajuato, Hidalgo, Jalisco, Mexico,

Michoacan, Morelos, Nayarit, Oaxaca, Puebla, San Luis Potosi, Sonora, Veracruz; El Salvador; United States: Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Virginia.

Type: In Walter Herbarium at BM, photo observed.

Crotalaria rotundifolia was first recognized as a distinct species by Walter (1788) who also recognized it as being congeneric with *C. sagittalis* L. Walter apparently thought that *C. rotundifolia* and *C. sagittalis* represented a new genus distinct from *Crotalaria*, but, instead of describing a new genus, he placed them in a miscellaneous category under the genus name *Anonymos*. A few years later, Gmelin placed Walter's *Anonymos* species under other genera (Sprague, 1939). *Anonymos rotundifolia* was placed with *C. sagittalis* L. under *Crotalaria*. In 1812, Poiret again published the combination, and he, rather than Gmelin, is frequently attributed the authorship of the combination *C. rotundifolia*. In 1814, Pursh also placed Walter's *Anonymos rotundifolia* into *Crotalaria*. He, however, proposed a new species name, *C. ovalis*, and cited Walter's name as a synonym, making *C. ovalis* a superfluous epithet when published and therefore illegitimate.

Senn (1939), after examining a photograph of Miller's type of *Crotalaria angulata*, thought that it was synonymous with *C. rotundifolia*, and the name has since been used for the American plants. In 1897, Britten and Baker examined the specimen and concluded it did not differ from *C. biflora* L. A comparison of the photograph of Miller's specimen with an IDC microfiche of a *C. biflora* specimen in the Linnaean Herbarium leads me to agree with Britten and Baker. In addition, Miller indicated that the flowers were produced singly on the sides of the branches and that the leaves were sessile. Neither of these characters agrees with the type from the Miller Herbarium. It may also be possible that Miller made a mistake in indicating the location of the place of origin of the seed. It now seems better to recognize the epithet of Walter and to reject the Miller name for our American plants.

Fernald and Schubert (1948), after studying photographs of Walter's Herbarium (taken by Schubert) at the British Museum of Natural History, suggested that the name *Crotalaria rotundifolia* actually refers to the plants with short appressed pubescence previously referred to as *C. maritima*. A more recent photograph of the specimen figured by Fernald and Schubert has been supplied by Dr. Norman K. B. Robson of the British Museum. Dr. Robson (personal communication) indicates that the plant has "appressed-sericeous" pubescence and would "run down easily in Senn's key to *C. maritima* Chap.". In light of this information, the name *C. rotundifolia* is recognized as applying to the material previously recognized as *C. maritima*, as Fernald and Schubert suggested.

Crotalaria rotundifolia may be distinguished by its procumbent, decumbent, or occasionally ascending habit; leaf-opposed inflorescences; and the presence of stipules. It is an extremely variable species, especially in the Florida peninsula.

Two varieties may be distinguished in the following way:

- Plants with appressed stem pubescence.
 10a. *C. rotundifolia* var. *rotundifolia*.
 Plants with spreading stem pubescence.
 10b. *C. rotundifolia* var. *vulgaris*.

10a. *Crotalaria rotundifolia* var. *rotundifolia* Figure 10, Map 5.

While plants of some populations in the higher Florida Keys and along the Florida Gulf coast have only narrow leaves, plants at most locations in the state are extremely variable. *Crotalaria linaria* Small was based on narrow leaved plants and was maintained by Senn as a variety of *C. maritima*. Since a narrow leaved plant usually cannot be differentiated as being from either the entirely narrow leaved populations or the heterogeneous populations on the peninsula, no purpose is served by maintaining the variety or by reducing it to the status of *forma*.

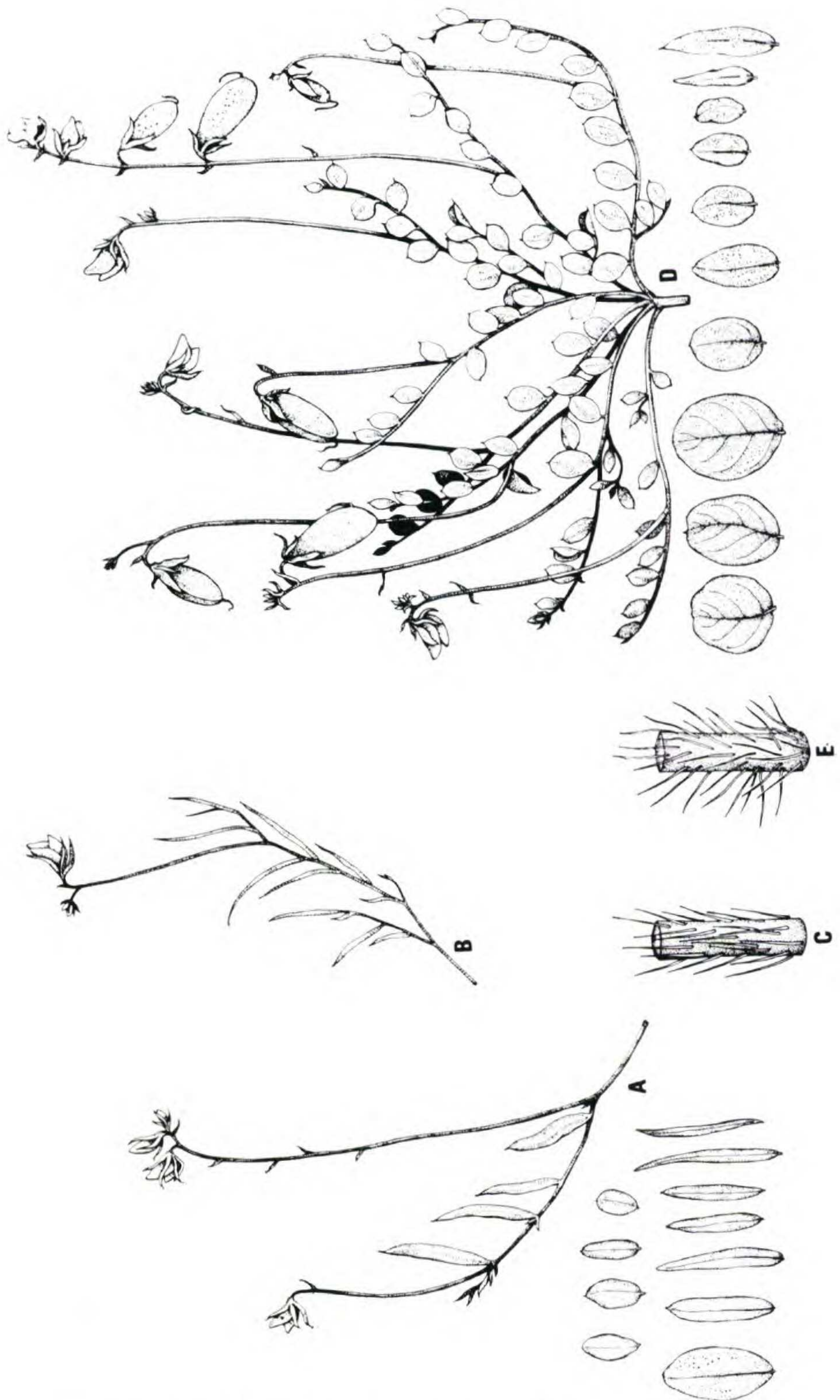
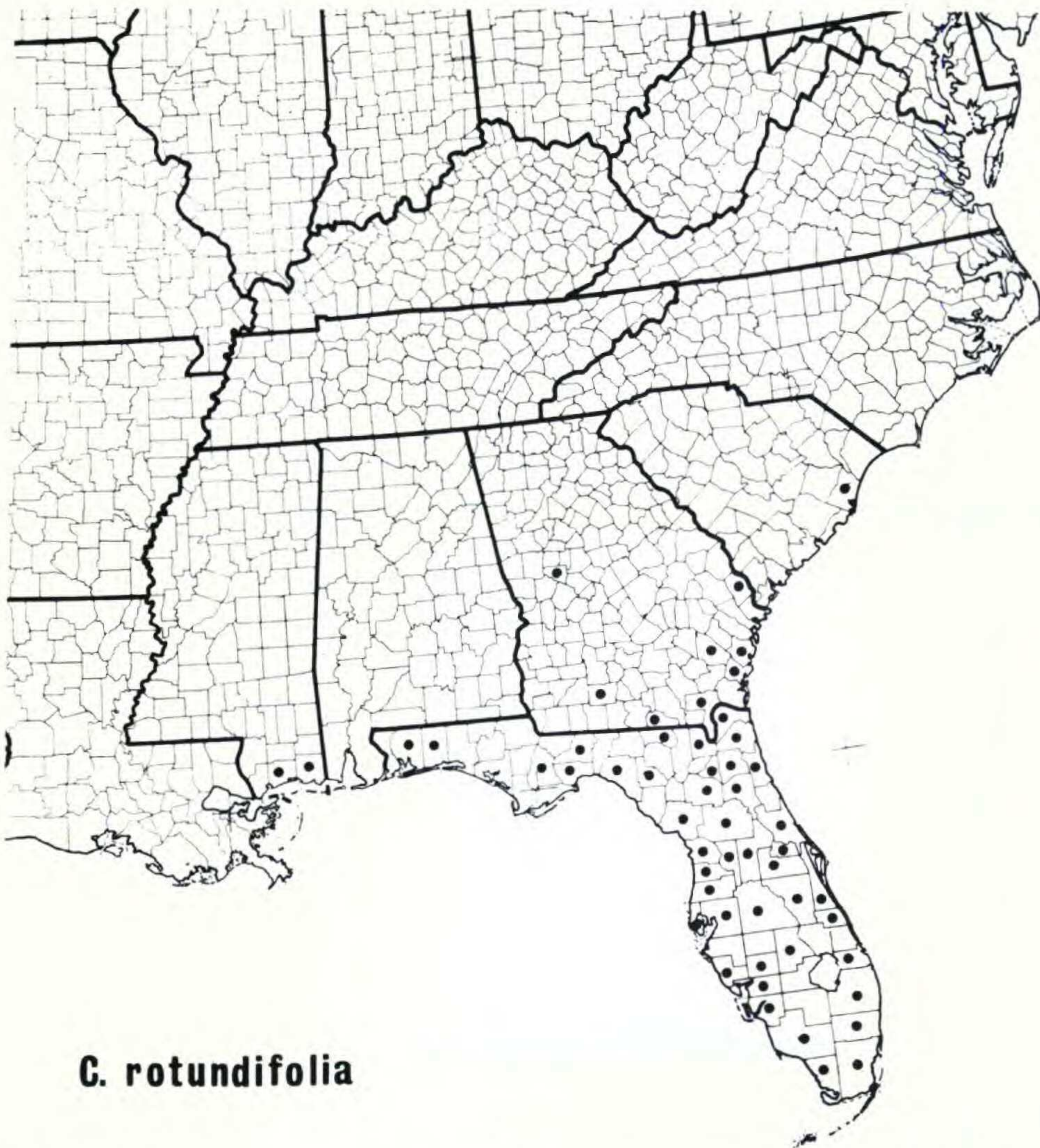
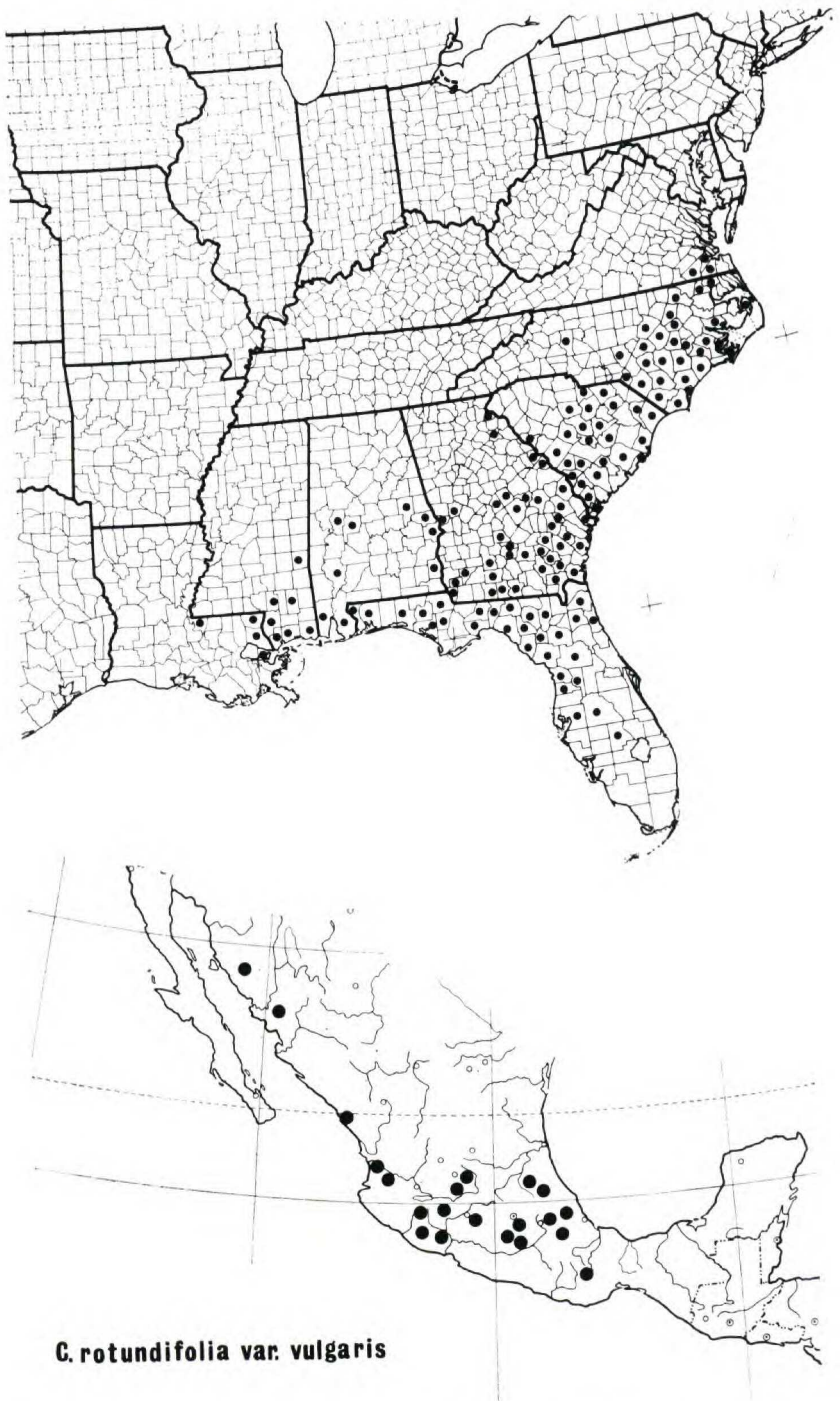


Figure 10. *Crotalaria rotundifolia* var. *rotundifolia*.
 A., B. Habit and leaf variation
 C. Stem
Crotalaria rotundifolia var. *vulgaris*
 D. Habit and leaf variation
 E. Stem



Map 5. Distribution of *Crotalaria rotundifolia*, var. *rotundifolia*.



Map 6. Distribution of *Crotalaria rotundifolia* var. *vulgaris*.

REPRESENTATIVE SPECIMENS: PUERTO RICO. Vicinity of Dorado, white sand, *Britton, Britton, & Brown* 6653 (US). UNITED STATES. **Florida:** LEVY CO.: evergreen scrub oak sandridge, Cedar Key, *Godfrey* 56571 (GA, GH, USF). MONROE CO.: open dry sandy swale behind low coastal shell ridge, Middle Cape, Cape Sable, Everglades National Park, *Ward* 3939 (GA, LAF, NCU). **Georgia:** MCINTOSH CO.: sandhill thicket 1.3 mi. N of Ft. Barrington, Cox Road on ridge, *Boseman* 458 (NCU). **Mississippi:** JACKSON CO.: Ocean Springs and vicinity of Gulf Coast Research Laboratory, sandy soil under pines, west end of Deer Island, *Channell* 414 (USF). **South Carolina:** GEORGETOWN CO.: roadsides, 5.6 mi. S of Maryville, *Radford* 28670 (NCU).

10b. *Crotalaria rotundifolia* var. *vulgaris* Windler, *Phytologia* 21: 264. 1971.

Crotalaria angulata Miller, 1768, sensu Senn, 1939. (See discussion above.)

Figure 10, Map 6.

Type: South Carolina: Hampton County, about three miles northwest of Yemassee on South Carolina Highway 68. Sandhill. 23 July 1967, *D. R. & B. K. Windler* 2769 (NCU).

Crotalaria rotundifolia var. *vulgaris* is distinguished by its spreading pubescence. Over most of its range var. *vulgaris* is also characterized by round to oval leaves, but in northern Florida and southern Georgia it intergrades with the usually narrower leaved var. *rotundifolia*.

REPRESENTATIVE SPECIMENS: COSTA RICA. Cartago, Elev. 4,500 ft., *Cooper* 165 (US). GUATEMALA. Chimaltenango: alt. 2,100 m., *Standley* 61485 (NY). PANAMA. Panama: roadside, Rio Tapia, *Standley* 28214 (US). EL SALVADOR. vicinity of San Salvador, alt. 650-850 m., *Standley* 22444 (NY). MEXICO. Baja California: San Antonio, Cape region, *Purpus* 475 (US). Guanajuato: 20 mi. NW of Irapuato, *Barkley, Rowel, & Parson* 752 (TEX). Hidalgo: Dist. Zimapan, on road from Hwy. at km. 242 to Encarnacion, *Moore & Wood* 4319 (MEX). Jalisco: 5 mi. W of Guadalajara on Hwy. 15, beneath cliff face in road cut, brown sandy soil, *Irwin* 1257 (TEX). Mexico: Lecheria, *Pringle* 13411 (GH, US). Michoacan: growing in oak, 2 mi. above Tancitaro, elev. 7,000 ft., *Leavenworth* 517 (GH). Morelos: km. 56-57, road from D.F. to Cuernavaca, roadside embankment, *Moore* 125 (GH). Nayarit: 13 mi. SE of Tepic, in red clay, *Irwin* 1293 (TEX). Oaxaca: Valley of Oaxaca, alt. 5,500-7,500

ft., *Nelson* 1481 (GH). **Puebla:** vicinity of Puebla, *Arsene* 1414 (US). **San Luis Potosi:** 15 mi. E of Ciudad del Marz on Rt. 80, ca. 1,000 m., *Mickel* 544 (MICH). **Sinaloa:** dry hill, vicinity of Mazatlan, *Rose, Standley, & Russell* 13823 (US). **Sonora:** 3 mi. NE of Matape, *Wiggins & Rollins* 400 (GH). **Veracruz:** Misantla, *Purpus* 5907 (GH, NY, US). UNITED STATES. **Alabama:** CLARKE CO.: near Choctaw Lake, elev. 170 ft., *Demaree* 50694A (LAF, NCU). **Florida:** HERNANDO CO.: Chinsegut Hill Bird Sanctuary, open area along margins of pine woods, *Windler* 1136 (NCU). **Georgia:** BEN HILL CO.: open pine-oak on sandy upland, 7.1 mi. N of Fitzgerald, *Duncan & Hardin* 14301 (GA). **Louisiana:** WASHINGTON PARISH: mixed woods, edge, along Pushepetappa Creek, 2 mi. WNW of Varnado, *Thieret* 25910 (LAF). **Mississippi:** LAMAR CO.: 12 mi. WSW of Hattiesburg along Black Creek, low area, *Doughty* 162 (MISS). **North Carolina:** BLADEN CO.: wet ditch on 701 to White Lake, *Radford & Radford* 2065 (NCU). **South Carolina:** BERKELEY CO.: common on sandy bank ca. 15 mi. S of Moncks Corner on 52, *Wilbur* 3547 (GA). **Virginia:** NANSEMOND CO.: dry white sand of pineland SW of Marsh Hill School S of South Quay, *Fernald & Long* 11050 (GH).

11. *Crotalaria bupleurifolia* Schlecht. & Cham., *Linnaea* 5: 575. 1830.

Crotalaria heldiana A. DC. in A. & A.P. DC. Mem. Soc. Phys. Geneve 9: 97. 1841. Type: Grown from seed of unknown source in the garden at Karlsruhe, (G!).

Annual or perennial spreading suffrutescent herb with a taproot to 2 cm. thick. Stems few-many, 5-27 dm. long, 2-3.5 mm. thick, the longest internode 3.5-10 cm. long; vestiture of spreading or loosely appressed trichomes 0.2-1.3 mm. long. Stipules present, decurrent for $\frac{1}{4}$ to the full length of the internode, 0.5-2.7 cm. wide at the top tapering slightly to or past the subtending node, the stipule lobes absent or spreading 0.5-3 cm. long. Leaves oval, elliptic, ovate, broadly lanceolate, or lanceolate, 3.2-10.2 cm. long, 7-46 mm. wide, base obtuse to cuneate, the apex obtuse, mucronate, acuminate, or acute; vestiture of both sides of spreading or loosely appressed trichomes 0.2-1.6 mm. long or nearly glabrous; petioles 2-3 mm. long. Inflorescences leaf-opposed, peduncles 2-16 cm. long. Bracts sessile, linear, subulate, or narrowly lanceolate, 4.5-7.5 mm. long, 0.3-0.6 mm. wide; pedicels 4-5.5 mm. long. Calyces

13.5-19 mm. long, the tubes 2.5-5 mm. long, bearing loosely appressed or spreading trichomes 0.1-1.1 mm. long; bracteoles linear, subulate, or narrowly lanceolate, 3-6 mm. long, 0.2-0.7 mm. wide. Corollas yellow, the standards 16-25 mm. long, equaling to 6 mm. longer than the upper calyx lobes; elongate anthers 2-2.8 mm. long, short anthers 0.5-0.7 mm. long; styles 7-11 mm. long. Fruits 3-4.1 cm. long, breadth not known; seeds tan, green-brown, or brown, number per pod not known, 2.2-2.5 mm. long. Chromosome number: $n=16$. Flowering time: August-March. Habitat: North-facing slopes and bluffs and cloud forests with firs and broad leaf trees, elevation 2,500-7,500 feet. Range: Mexico: Chiapas, Guerrero, Jalisco, Mexico, Michoacan, Sinaloa, Veracruz.

Type: Hacienda de la Laguna? *Schiede et Deppe s.n.* (G!).

Crotalaria bupleurifolia was described by Schlechtendal and Chamisso in an article describing the collections of Schiede and Deppe in Mexico. A specimen collected by Schiede and Deppe at G is marked "Typus" and may well represent the type even though the location on the label reads "Mexique. Cuerta grande de Chiconquiaco" rather than "Hacienda de la Laguna" cited with the original description of *C. bupleurifolia*. The number 596 cited with Schiede's name in Senn (1939) refers to the species number which accompanied Schlechtendal et Chamisso's description.

Crotalaria bupleurifolia is characterized by its generally large size, unusual stipules, and large flowers and habit. It most closely resembles *C. nayaritensis* but may be distinguished from it by the large flower size, larger overall size, and usually wider stipules.

Two varieties may be recognized:

- Stipules present only at the base of peduncles, decurrent for only a single internode.
 11a. *C. bupleurifolia* var. *bupleurifolia*.
 Stipules present at the base of most leaves, frequently decurrent for more than one internode.
 11b. *C. bupleurifolia* var. *robusta*.

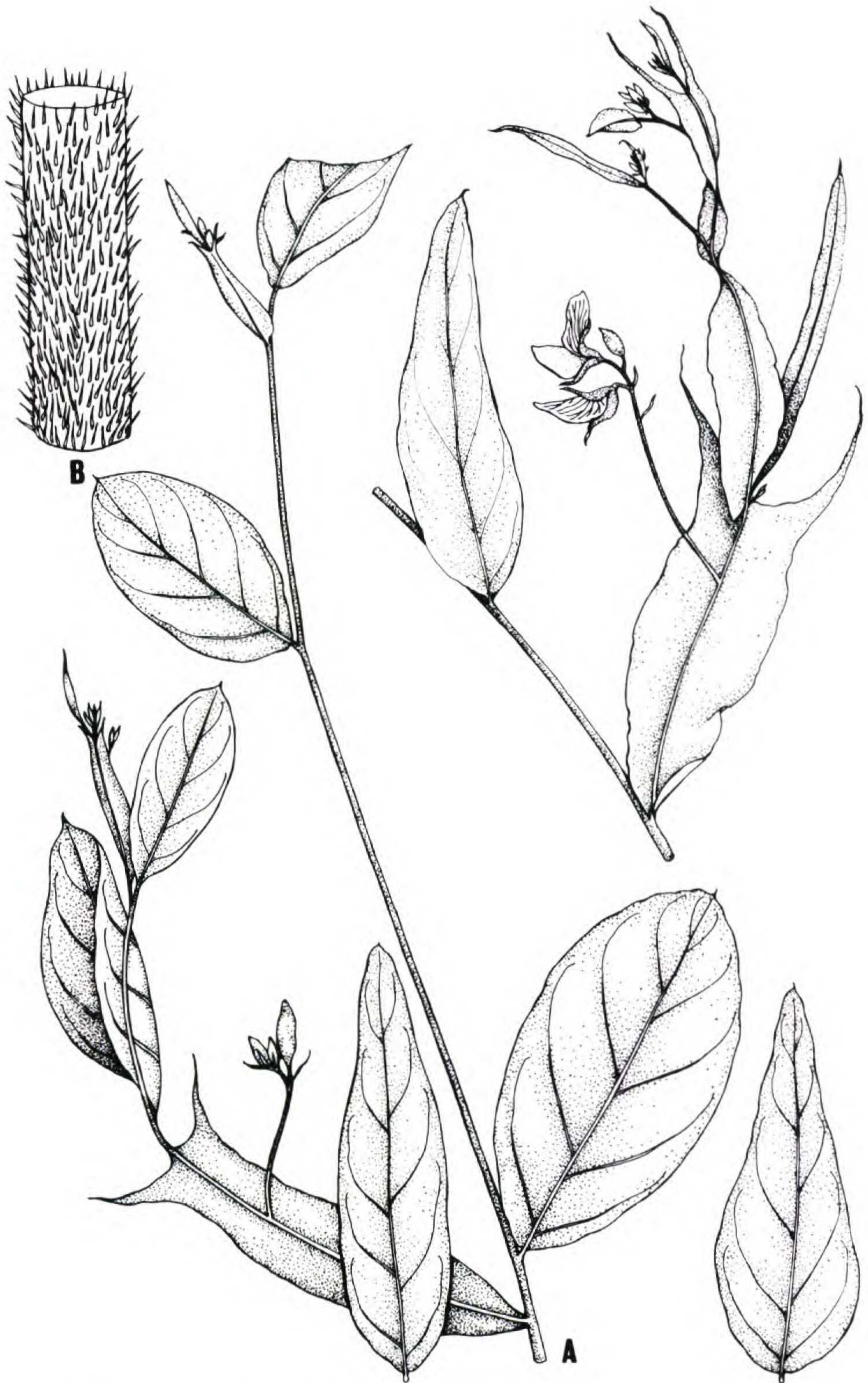
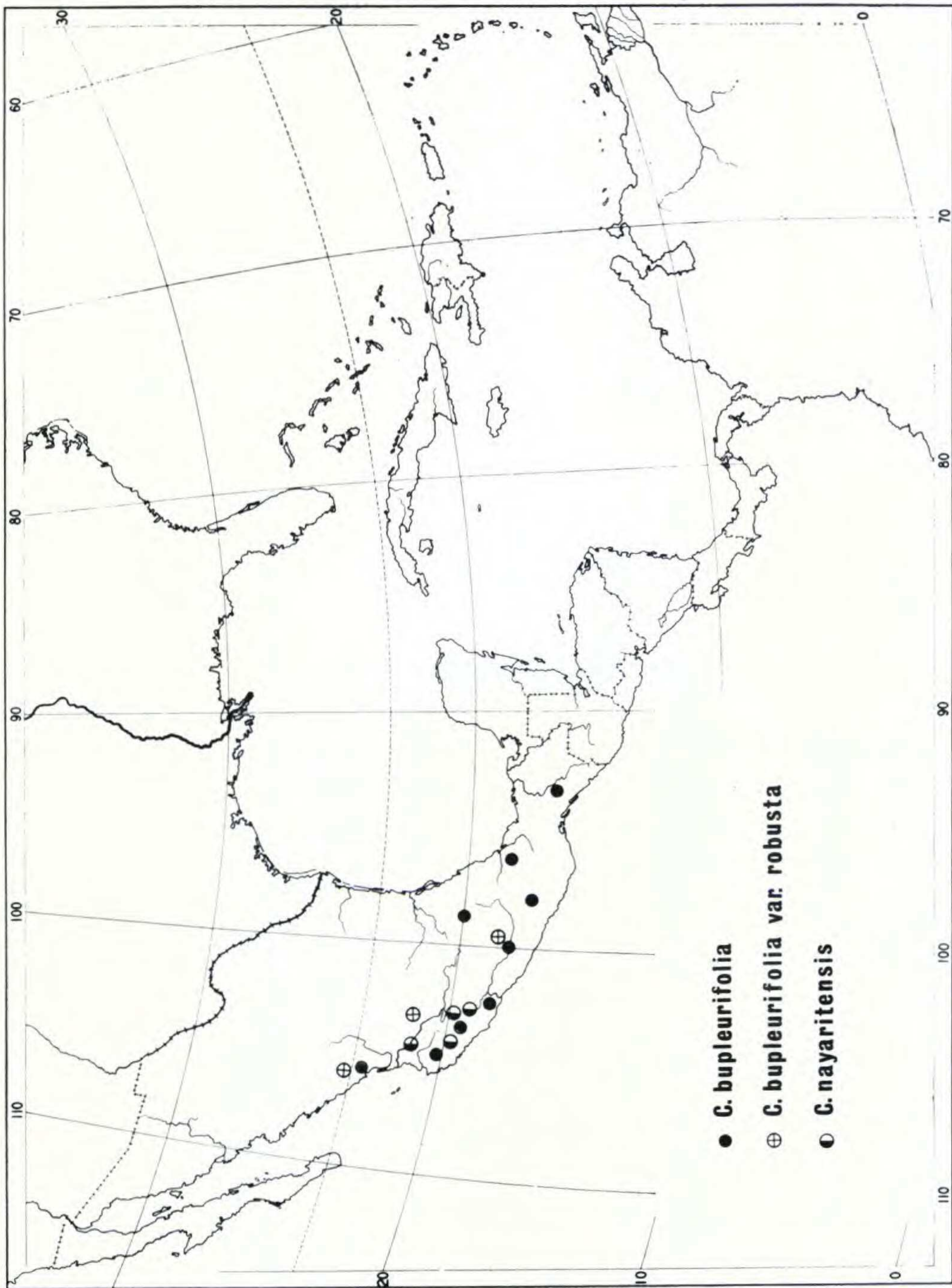


Figure 11. *Crotalaria bupleurifolia* var. *bupleurifolia*.
A. Habit and leaf variation
B. Stem



Map. 7. Distribution of *Crotalaria bupleurifolia* var. *bupleurifolia*, *C. bupleurifolia* var. *robusta*, and *C. nayaritensis*.

11a. *Crotalaria bupleurifolia* var. *bupleurifolia* Figure 11, Map 7.

REPRESENTATIVE SPECIMENS: MEXICO. Chiapas: NE of Bochil, *Miranda* 5746 (MEXU). Guerrero: San Antonio Buenos Aires, *Hinton* 11708 (GH, TEX, US). Jalisco: near Santa Monica, 1,950-2,050 m, *McVaugh* 14086 (MEXU, MICH, US). Mexico: Rincon del Carmen, Dist. Tamascaltepec, 1,340 m, *Hinton* 1730 (MEXU, NY, US). Michoacan: NW of Aguililla, 15 Km S of Aserradero Dos Aguas, 1,650-1,700 m, *McVaugh* 22767 (MICH). San Luis Potosi: Las Canoas, *Pringle* 8 (MEXU). Sinaloa: Batel, Concordia, *Dehesa* 1619 (US). Tamaulipas: 10 Km NW of El Progreso, 1,450 m, *Stanford*, *Retherford*, & *Northcraft* 1009 (GH). Veracruz: Barranca de Tenampa, Zacuapan, *Purpus* 3663 (GH, NY, US).

11b. *Crotalaria bupleurifolia* var. *robusta* (Senn) Windler, *Phytologia* 21: 265. 1971.

Crotalaria pilosa var. *robusta* Senn, 1939, 41: 331. Figure 12, Map 7.

Type: Temascaltepec, Cumbre de Tejupilco, *Hinton* 2686 (US!).

REPRESENTATIVE SPECIMENS: MEXICO. Jalisco: 10 Km al N de La Cuesta, sobre el camino a Talpa, 1,100 m, *Rzedowski* 15134 (MEXU). Mexico: Plaza de Gallos, 1,200 m. *Hinton* 4595 (GH, NY). Sinaloa: Km 1206 on Mexico Hwy. 40, ca. 30 mi. E of Mazatlan-Guadalajara Junction, 2,700 ft., *Windler & Windler* 2869 (NCU).

12. *Crotalaria nayaritensis* Windler, *Phytologia* 21: 261. 1971.

Annual or perennial spreading herb with a taproot to 1.5 cm. thick. Stems 1-many, 6-12 dm. long, 1.5-2.5 mm. thick, the longest internode 3.8-10 cm. long; vestiture of short appressed trichomes, 0.2-0.7 mm. long. Stipules present, decurrent the length of the internode, 0.15-1.1 cm. wide at the top tapering to or past the subtending node, the stipule lobes parallel with the stem or spreading, 0.1-1.3 cm. long. Leaves oval, elliptic, ovate, narrowly ovate, oblong or lanceolate, 3.5-7.8 cm. long, 7-26 mm. wide, base obtuse to cuneate, the apex obtuse, mucronate, acuminate or acute; vestiture of both surfaces of appressed or loosely appressed trichomes 0.3-0.8 mm. long; petioles 1.2-2.5 mm. long. Inflorescences leaf-opposed, peduncles 3.2-16 cm. long.

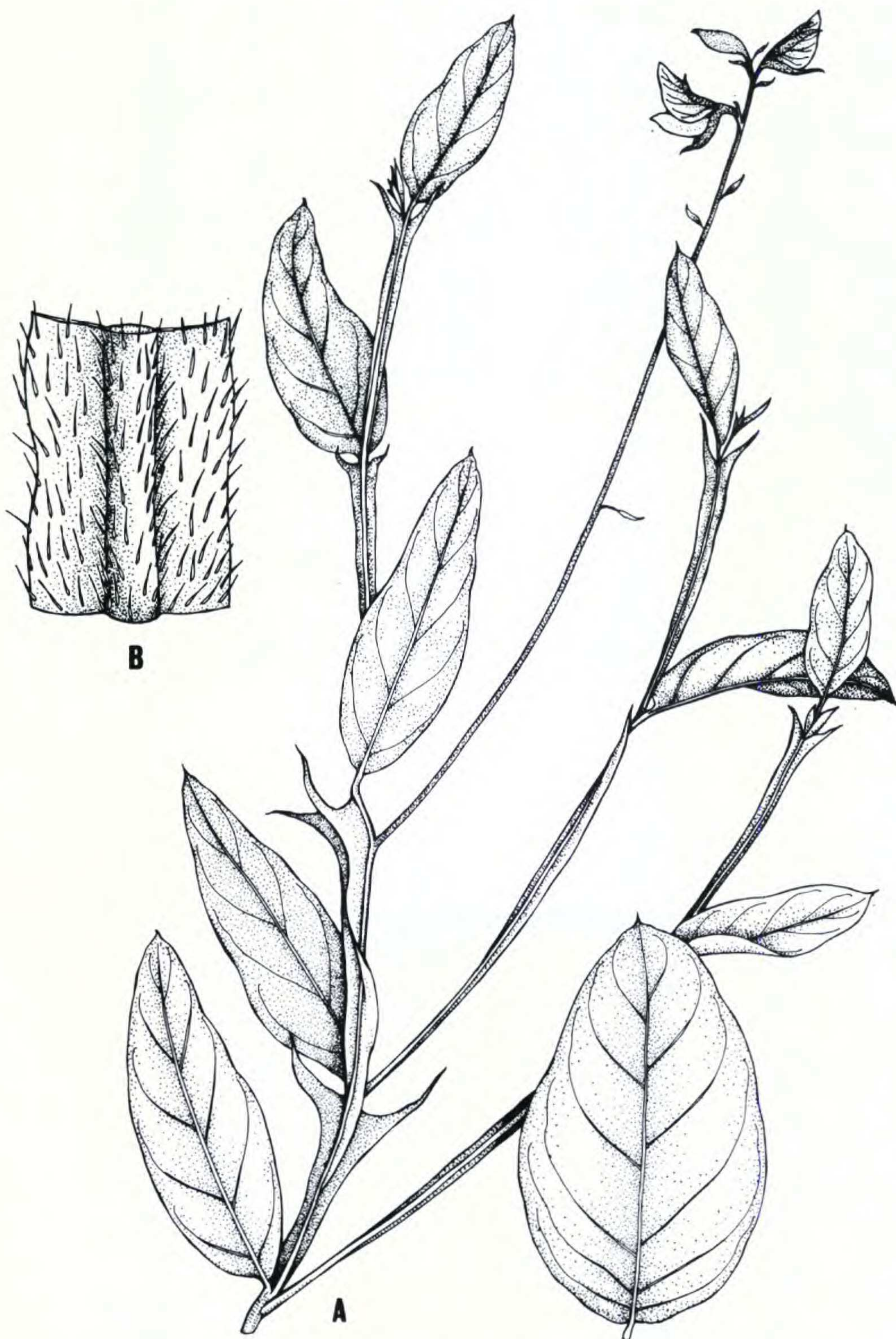


Figure 12. *Crotalaria bupleurifolia* var. *robusta*.
A. Habit and leaf variation
B. Stem

Bracts sessile, linear or elliptic lanceolate, 3-4.5 mm. long, 0.2-0.5 mm. wide; pedicels 2.8-3.8 mm. long. Calyces 7.5-12 mm. long, the tubes 2-3.2 mm. long, bearing appressed trichomes 0.1-0.5 mm. long; bracteoles linear or narrowly lanceolate, 1.5-3 mm. long, 0.2-0.3 mm. wide. Corollas yellow, the standards 7-12.5 mm. long, 2 mm. shorter to 1 mm. longer than the upper calyx lobes; elongate anthers 1.3-2.1 mm. long, short anthers 0.4-0.5 mm. long; styles 5-6 mm. long. Fruits 1.3-2.3 cm. long, 0.5-0.8 cm. broad; seeds tan, grey-tan, green-brown, brown or red-brown, 30-35 per pod, 1.6-2.4 mm. long. Chromosome number: $n=16$. Flowering time: August-February. Habitat: steep moist slopes and pine woods, elevation 2,500-6,600 feet. Range: Mexico: Jalisco, Nayarit. Figure 13, Map 7.

Type: Mexico: Nayarit, North of Compostella (near Km. 24), about 7 miles southwest of Tepic, along road between Tepic and Compostella. Road-cut through mountain on moist steep slope, *Windler & Windler* 2902 (NCU).

Crotalaria nayaritensis is a new species named for the Mexican state from which the holotype was collected. It is characterized by its spreading or diffuse habit, leaf-opposed inflorescences, small flower size, and appressed pubescence. Of the Mexican species it most nearly resembles *C. bupleurifolia*, but differs from it in having a smaller flower, appressed pubescence and usually narrower stipules.

REPRESENTATIVE SPECIMENS: MEXICO. **Jalisco:** 13 mi. SW of Autlan, 1,000 m, *McVaugh* 19886 (MICH); Llano Verde, municipio de Tecalitlan, 1,600 m, *Rzedowski* 17417 (MICH); 3 mi. S of Mazamitla, 2,100-2,200 m, *McVaugh* 12997 (MICH, US); San Sebastian, W to Mascota, 1,425 m, *Mexia* 1408 (US); Tepic, *Palmer* 1869 (NY, US). **Nayarit:** 10 mi. SE of Ahuacatlan, 1,100-1,300 m, *Fedema* 287 (MICH); N of Compostella, 3,000 ft., *Windler & Windler* 2902 (NCU); Mina Esperanza Rosa Morada, *Ortega* 6682 (US); 2 mi. N of Tepic, 3,000 ft., *Windler & Windler* 2897 (NCU).

PUTATIVE HYBRIDS BETWEEN CROTALARIA SPECIES

During the course of the study a number of putative hybrids were observed. The following presentation sets

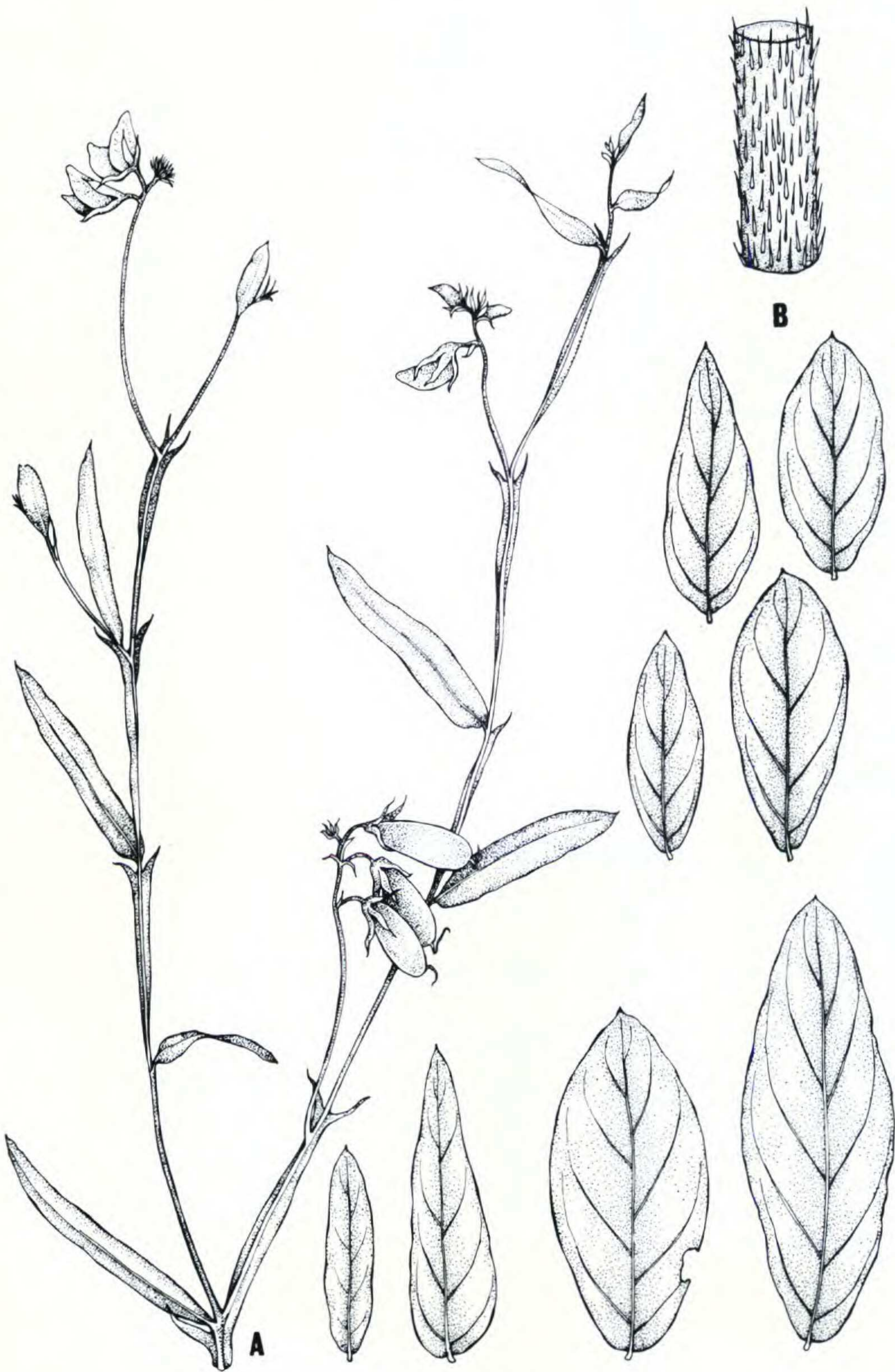


Figure 13. *Crotalaria nayaritensis*.

- A. Habit and leaf variation
- B. Stem

forth the probable parents and lists of representative specimens which appear to be the results of crosses between the parents.

Crotalaria sagittalis* × *C. stipularia

ST. KITTS. Pastures near Sandy Point, *Britton & Cowell* 128 (NY).

Crotalaria sagittalis* × *C. rotundifolia* var. *vulgaris

UNITED STATES. **Alabama:** Mobile, *Mohr s.n.* 1873 (SIU). **Florida:** BAY CO., E of Panama City, *Windler & Windler* 2723 (NCU); N of Betts, *Windler & Windler* 2721 (NCU); ESCAMBIA CO., W of Century, *Windler & Windler* 2688 (NCU); JACKSON CO., Grand Ridge, *Windler & Windler* 2712 (NCU); OKALOOSA CO., 4 mi. W of Blackwater River Bridge on Fla. Hwy. 4, *Windler & Windler* 2700 (NCU); SANTA ROSA CO., E of Chumuckla, *Windler & Windler* 2693 (NCU); S of Milton, *Windler & Windler* 2697 (NCU). **Mississippi:** FOREST CO., S of Hattiesburg, *Windler & Windler* 2659 (NCU); HARRISON CO., N of Biloxi, *Windler & Windler* 2666 (NCU); LAMAR CO., 8.5 mi. SE of Hattiesburg, *Cooley* 62 (MISS); 7.5 mi. SW of Hattiesburg, *Cooper* 93 (MISS); Pearl River, 1 mi. N of Picayune, *Pullen* 641208 (MISS).

Crotalaria sagittalis* × *C. quercetorum

MEXICO. Chiapas: Bochil, *Windler & Windler* 2994 (NCU).

Crotalaria rotundifolia* × *C. purshii

UNITED STATES. **Alabama:** BALDWIN CO., Foley, *Windler & Windler* 2681 (NCU). **Florida:** CALHOUN CO., ½ mi. S of Clarksville, *Windler & Windler* 2425 (NCU); ESCAMBIA CO., 2½ miles N of Jct. Fla. Hwy. 97 — US Hwy. 29, *Windler & Windler* 2686 (NCU); SANTA ROSA CO., S of Milton, *Windler & Windler* 2699 (NCU). **Georgia:** GLYNN CO., Brythe Island, *Hardin & Duncan* 13785 (NCU); MCINTOSH CO., 2.6 mi. W of Cox, *Bozeman* 1078 (NCU); 1 mi. SE of Ft. Barrington, *Boseman & Radford* 2146 (NCU); THOMAS CO., SW of Thomasville, *Windler & Windler* 2734 (NCU). **Mississippi:** HARRISON CO.: Ship Island, *Demaree* 35028 (LAF); JACKSON CO., Round Island, *Demaree* 33742 (LAF).

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TOWSON STATE COLLEGE
BALTIMORE, MARYLAND 21204